Master's degree thesis

LOG 950 Logistics

What are the cost Drivers at Inventory

A case study to find the cost drivers at inventory in dual channel distribution warehouse

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Preface

This thesis is the final part of my 2 years of Master of Science in Logistics program at Molde University College Molde Norway. I am deeply thankful to my supervisor, Program Director Berit Irene Helgheim (Faculty of Logistics') Molde University College; whose help, motivation suggestions and encouragement helped me in all the time of research and in writing of this master thesis. I would like to give my special gratitude to her, she is always very kind to me and help me even in my personal matters. I also present my gratitude to the Dean "Svein Bråthen" for providing golden opportunity to study at Molde University College and the opportunity to finish the master thesis. I would like to thank the University and the library staff members who always helped me.

I would also like to thank all the people who helped and contributed to this research, a special thanks to the companies, and especially the warehouse managers and employees, for helping and participating in this study and sharing of their important information for my research purpose. Although, this year is really challenging for each of us due to pandemic of COVID 19. And due to this I was unable to get complete data and don't get proper observation. As there was governmental lockdown in the March to May 2020 in Norway, all stores, offices are closed and mostly officials are working from home which creates aproblem to get proper information for our analysis purpose.

Last but not least I acknowledge the family members, friends classed fellow students for support, love, encouragement, for this master thesis and motivation and support during my whole studies.

Molde, May 2020   *Qamar Bilal Iqal*

Abstract

The new trend of online shopping creates an opportunity for retailers to offer their products and services online. This shift from retail to e-tail is big challenge for companies to survive in competitive environment. This is only possible, if company's supply chain is agile all operations are fully synchronized. Becoming a market leader is very difficult until companies are cost efficient, companies can only be cost efficient if they know the factors that contribute towards cost and revenue.

This study is to find the cost drivers to inventory in web shopping; our main purpose is to find the main factors contribute to inventory in warehouse and then to find the influence of those factor. When retails offer the e-tail, the dual distribution channel need more efficient because they receive more order from both channels, need more resources to fulfill the stochastic demand.

For that purpose, we choose two stores that are offering both the retail and e-tail distribution and we get data of their warehouses respectively. Both are operating dual distribution channel and we find the cost drivers that are contributing to the total cost of inventory in warehouse. We find that there are four major factors that directly effect on the inventory like, most important one is the inventory holding cost. All businesses hold the inventory to avoid stock out position (as that is directly the loss of sale), warehouse land cost, labor charges, Machinery &tools cost and the maintenance cost of machinery and building to keep efficient supply chain of retail and e-tail. There is a few work on the dual distribution of warehouse operation and cost therefore, it is important to fill the research gap and provide information to find the major cost drivers and their relationship towards the inventory cost, we do analysis using regression analysis to find the correlation of these factors.

The study also offers managerial insights implications on some critical issues faced by companies operating in a dual-channel context. Due to customer convenience the future trend is E-commerce and every retailer offering dual distribution retail and online so, it is important to know the major cost driver to inventory and their influence to minimize the cost and to become competetive.

Keyword: Dual-channel, Multi-channel, E-commerce, e-tail, retail, warehouse operations, Inventory.

Contents

1 Introduction

1.1 Introduction And Background Of Topic

After the industrial revolution, innovation in the field of internet considered the most significant development towards digitalization. The word globalization and technology are profound meanings, more intelligent, and has much potential to explore. Advancement in the field of the internet is making customer's life easier and also gives an opportunities to the businesses to become globalize and capture the world market. Nowadays, technology is changing the basic structure of every field like advancement in scientific research, social life, financial calculations and predictions, managerial decision making much more comfortable with the help of Technology (Patil and Divekar 2014). The word that has affected almost everything in the world is "Globalization." Globalization has increased the opportunity for the manufacturers to enhance their customer base worldwide, while it has also increased the competition in the market. Globalization has also affected the companies` supply chains since they have become more complex and critical than they were ever before (Savitz 2012).

The online shopping stores is e-commerce that allows customers to buy goods directly from manufacturer or retailers by their online web stores, for example, e-bay, Amazon, Alibaba, Ali Express, and Zalando and many others. Many smartphone apps are handy to buy or sell. These apps facilitate the customer to provide a wide range of products and a competitive market for manufacturers. Consumers can find a product of their interests by using the shopping engine or any search engine like Google, Oral, Safari, which displays the product's availability and pricing at different e-retailers. Due to artificial intelligence now, the consumers are becoming more and more intelligent and save a lot of money and time to buy quality products and services. The internet makes it easy for the customer to compare product prices and feathers with competitors. Different companies of the world are spending much budget on increasing their access to the world and marketing of their products online.

Web shopping is prevailing in the society because of easiness it provided services to the number of customers that can avail different things on their doorsteps. E-commerce played a significant role in offering such comfort to the consumers as well as to the organizations. The production market using web shopping and e-commerce services prevails the economic growth of the companies largely. According to(Arvis et al. 2016), the phenomena of web-shopping emerged first in the 1990s. With the increase in the use of the internet, online shopping provides consumers the advantage to shop from different stores as per their choice.

In contrast to this, there is a big challenge for the production and retail companies due to web shopping. The main issue related to the competitive analysis that is faced by several companies about the online shopping of different products particularly. The availability of stock (inventory) of the shopping goods which can result in providing difficulties amongst the consumers primarily, and in some cases, consumers can be violated significantly(Lehmann and Jungwirth 2019). The prestigious and competitive organizations such as Amazon, Alibaba, and eBay companies have earned more than 50% of the total global web sales.

Nowadays, almost all the companies have e-commerce websites which have considered as the sign of improvised business standards. It is not only considered as the product marketing tool. The web stores become the need of the hour in this era of complete digitalization and online services. These online features provide more customer engagements and better turn over. One of the main reasons why e-commerce web stores become part and parcel of all businesses because of its efficient inventory management. With the help of a web store, the manufacturer not only showcases the new arrivals but also calculates the comprehensive analytics from each outlet with inventory management. The importance of the e-commerce web stores could determine that it is now included in business decisions because computerized analytics provide the best results of the profit/loss and provide a visual graphical presentation of the facts and figures. Thus this becomes a standard of enterprise-level companies to offer the facility of e-commerce (Baršauskas, Šarapovas, and Cvilikas 2008).

According to various estimates, from 51.6% to 54% of Internet users do shopping through online retailers. However, there are severe problems with storage capacity, many retailers cannot afford the dedicated warehouse and expensive to bear the operational and maintenance cost of warehouse so, small online stores prefer to use aggregators' services. Even though this facilitates the transfer of storage facilities to the regions, managing logistics

of the areas is more complicated and expensive than the retailing shops present in the local and regional market(Sarkis, Meade, and Talluri 2004).

The combination of physical stores with online, that is, the trend of new retail to e-tail, will undoubtedly become the mainstream of economic development in the next 20 years(Mangan and Lalwani 2016). This development has made a significant impact on retail logistics over the last decade(Mena et al. 2016). Based on the background of new technologies, big data, and the internet, to enhance the shopping experience of customers, physical stores will rise again. The most popular categories of goods that are most in-demand in global online trade are clothing and shoes, home electronics, and books. Although it is very challenging and costly to manage all activities and make customers happy, technology is helping to do that. It helps to offer better services and reduce costs and minimize the risk and increase market share. Due to the increase in online customers and demand in buying and market competition, every big company uses different marketing channels and distributions. Because they receive the demand for every channel of distribution.

There are many reasons to adopt different channels of marketing. One of them is the development in the information technology, and manufacturing facilities provides many additional capabilities to engage the customer in subgroups(Anderson, Day, and Rangan 1997), another cause to have different marketing channel is, to the ongoing expansion of sales. Though there are many obstacles which must be faced by having multiple channels, including channel conflict, it enables the capture of customers from different segment of the market (Webb 2002) and various pricing policies for the different channel (Tang and Xing 2001) and distribution approaches. While any firm increases the sales channel, it becomes essential to analyze the economic outcome of different distribution approaches (Alptekinoğlu and Tang 2005). Web shopping has become a necessary tool for all sizes of businesses worldwide, not only to sell the product but also to engage them.

It is not easy to achieve a completive advantage because of internal efficiencies that become more transparent. The additional reduction cost and improvised quality offer a slight competitive advantage. The increase in the supply chain is the answer to why we should reduce the inventory cost. From the operating expense, 75% consumed in the supply chain management tell the importance of supply chain efficiencies. It is the most challenging process for any retailer to manage the inventory to make high turn-over and ensure on-time delivery. Inventory management is a significant challenge for a retailer to introduce a flexible system that can respond accordingly. In retail, time lead is substantial, which creates the right image in the customer.

Moreover, wrong and lousy forecasting become the cause of demand fluctuations, which challenged the retailer. There is a most significant obstacle for an online retailer is to manage reserve logistics. The process of manage the product return for possible recycle, remanufacture, or resale is known as reverse logistics. It always increases the cost of the product because of extra labor and time consumed. The online retailer has to face more reverse logistics as compared to the outlet retailer. The management of the returned product and its disposal becomes a hurdle in profit-making and cost more than a new product(Snyder and Hamdan 2009).

There is a list of challenges that is associated to managing the cost, demand fluctuation, seasonality, reverser logistics, hold cost, labor cost, ordering cost, stock out position, maintenance cost, tools and equipment cost, warehouse lease or rent cost and many other hidden costs. This study is about to find the main cost factors which increase the inventory cost when a firm introduce or running dual channel of distribution warehouse.

1.2   Global Trends In Web Shopping

According to (emarketer 2019) global retail markets reached a level of $25.038 trillion. It was a growth of 4.5% more as compared to previous years. In that report, there was an estimation that the global e-commerce market will rise to 20.7% in 2019, which approximately become $3.53 trillion. In the previous years, the growth rate was more than 2019, which is 28.0% in 2017 and 22.9% in 2018, yet according to (emarketer 2019), by 2012, the volume of the global e-commerce market will be approx. %5trillion. At the beginning of 2020, the growth rate has fallen below the 20% threshold.

Retail Ecommerce Sales Worldwide, 2017-2023
trillions, % change and % of total retail sales

Retail ecommerce sales: $2.382 (2017), $2.928 (2018), $3.535 (2019), $4.206 (2020), $4.927 (2021), $5.695 (2022), $6.542 (2023)

% change: 28.0% (2017), 22.9% (2018), 20.7% (2019), 19.0% (2020), 18.1% (2021), 15.6% (2022), 14.9% (2023)

% of total retail sales: 10.4% (2017), 12.2% (2018), 14.1% (2019), 16.1% (2020), 17.1% (2021), 20.0% (2022), 22.0% (2023)

■ Retail ecommerce sales
■ % change   ■ % of total retail sales

Note: includes products or services ordered using the internet via any device, regardless of the method of payment or fulfillment; excludes travel and event tickets, payments such as bill pay, taxes or money transfers, food services and drinking place sales, gambling and other vice good sales
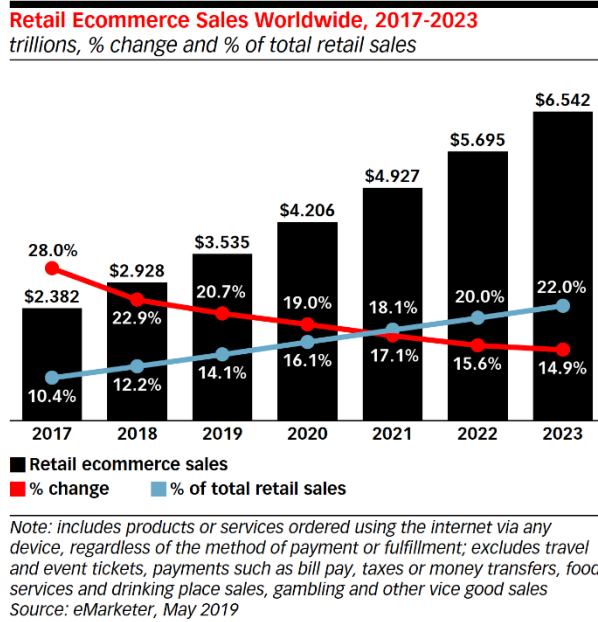*Source: eMarketer, May 2019*

Figure 1: Retail e-commerce sales worldwide, 2017-2023(emarketer 2019)

The above figure 1 presents the statistics of globally retail e-commerce sales from 2017 to 2023. In the year of 2017, there were $ 2.3 trillion of e-commerce sales globally. Similarly, in 2019, e-commerce sales amounted up to $3.53 trillion. There is projected revenue growth from e-commerce until 2023, more than worth of $6.53 trillion. Online shopping web store is one of those websites which has frequently used globally. In 2017, the top three sites secured an amount of more than $100 billion. The use of websites and trends of online shopping is also varied with geographical areas. For instance, China utilizes 19% of online retail sales globally than the rest of the world. Same as Japan, share 6.7% of the global online retail. The United Kingdom had the highest per-capita spending on online shopping in 2010, which tells us the trend of online shopping in the developed countries.

Similarly, in 2013, the Czech Republic was a European country, where 24% of the country's revenue generated by online retail and e-commerce. Like all other economic filed, in China, the number of internet users increases day by day, and according to a report, China's e-commerce market expends by every year. Chines online retailer market has much potential to provide more services and occupied more market volume. According to a report, China's e-commerce transactions between other countries increased by 32.0% ($375.8 billion) in 2012, which is 9.60% of China's total global trade. In 2013, a famous e-commerce web store Alibaba had a market share of 80.0% in China, which clearly shows how the developed countries trends towards online shopping. Similarly, in 2014, 600 million internet users belong to China made China the world's most significant online market.

Top 10 Countries, Ranked by Retail Ecommerce Sales, 2018 & 2019

billions and % change

	2018	2019	% change
1. China*	$1,520.10	$1,934.78	27.3%
2. US	$514.84	$586.92	14.0%
3. UK	$127.98	$141.93	10.9%
4. Japan	$110.96	$115.40	4.0%
5. South Korea	$87.60	$103.48	18.1%
6. Germany	$75.93	$81.85	7.8%
7. France	$62.27	$69.43	11.5%
8. Canada	$41.12	$49.80	21.1%
9. India	$34.91	$46.05	31.9%
10. Russia	$22.68	$26.92	18.7%

*Note: includes products or services ordered using the internet via any device, regardless of the method of payment or fulfillment; excludes travel and event tickets, payments such as bill pay, taxes or money transfers, food services and drinking place sales, gambling and other vice good sales; *excludes Hong Kong*
Source: eMarketer, May 2019

Figure 2: World's top ten country of e-commerce revenue (emarketer 2019)

The study shows that the e-commerce market will grow to $20 billion by the year 2020, mainly in GCC countries (Yuldashev). Not only in GCC but also in western countries, Europe and the US, primarily e-commerce and online shopping, are becoming famous rapidly. These countries have highly characterized by consumer-packaged-goods. West region of Europe owns three of the top six e-commerce markets, led by the UK ($141.93 billion), Germany ($81.85 billion), and France ($69.43 billion). As more mature markets, each is growing at year-over-year rates well below the global e-commerce growth rate(emarketer 2019).

After 2020, according to a study, global E-commerce sales will be double, and Asia-Pacific will still lead to global e-commerce growth. The anticipated growth of 25% to $2.271 trillion, representing 64% of global spending on e-commerce. Another region like, Latin America, Africa, and the Middle East will also experience a 21% growth in the use of e-commerce.

Retail Ecommerce Sales Growth Worldwide, by Region, 2019
% change

Asia-Pacific	25.0%
Latin America	21.3%
Middle East & Africa	21.3%
Central & Eastern Europe	19.4%
North America	14.5%
Western Europe	10.2%
Worldwide	20.7%

Note: includes products or services ordered using the internet via any device, regardless of the method of payment or fulfillment; excludes travel and event tickets, payments such as bill pay, taxes or money transfers, food services and drinking place sales, gambling and other vice good sales
Source: eMarketer, May 2019

Figure 3: *Retail E-commerce sales growth worldwide, by region(emarketer 2019)*

The main products of online shopping are books, electronics and media, household furniture, appliances, fashion & personal care, food, and clothing. Due to ease in shopping and time saving, there will be no end of the new trend in the market, and it is a significant challenge for countries to manage the B2C business, need more resources, and developed logistically infrastructure, fast and more agile supply chain, with the help latest technology.

As a case study, take the example of Norway, the population of Norway census approx. 5.3 million people. Almost 98% of the people are internet users; from the entire community, 81% are used frequently in online shopping facilities. These online shoppers or e-shoppers, on average, spend more than 30,000 Norwegian Krone per year, which is almost 3.84% of GDP. According to an estimate, there will be a 25% increase in the use of e-commerce web stores in Norway till 2023. The Norwegian E-commerce sales reached 12.82 Billion euros in 2019, which means there has been a 1.8% e-commerce growth. The VAT-rate in Norway is 25%. B2C e-commerce sales in Norway expected to grow to 16.4 billion Euros by 2020(Europe 2020)

Figure 4: Norway e-commerce history (Europe 2020)

The Norwegian B2C E-commerce market accounted for 11.68 euros billion in 2018. This year, the top 5 online stores in Norway accounted for 18% of the total Norwegian E-commerce market. Norway ranks 6th regarding E-commerce penetration 81% of the Norwegian population is shopping online. Not surprisingly, komplett.no led the online stores' list by net sales in the Norwegian in 2018. Other large and prominent players on the Norwegian market are, e.g., elkjop.no, kolonial.no, netonnet.no, and xxl.no. Consumer Electronics and Books, Movies, Music & Games are mainly searched for and bought online. Clothing and Books, Movies, Music & Games are the main categories for online shopping in Norway. The top 2 interests of Norwegian online shoppers are Food & Drinks and Clothing(ecommerceDB 2020).

1.3 Supply Chain Management

The management of the supply chain refers to the control of all flow of goods and services, including information like feedback from the market. It involves the handling of raw-material, inventory, and all processes include from the origin point to consumption point. Supply Chain Management also refers to the planning and execution of all necessary action for making a profit by reducing the cost and expenses.

1.4 Role Of Supply Chain Management In Web Shopping

Companies want a competitive advantage, which is only possible if they are competing in the market. There are many challenges associated with the companies and some additional problems for online businesses like procurement, shorter lead time, cost competitiveness, low inventory cost, minimum labor cost and capital cost, maximum throughput, a wide range of loyal and repeated satisfied customers. Companies are doing business with B2B and B2C simultaneously facing different and complex challenges, high inventory costs because of wrong forecasting, fluctuating demand, stock out position, short lead time.

Supply chain helps the retailers manage all these activities like better forecasting, better communication flow, better and smoother product flow from the point of production to the end of sales to end-user and helps to manage better and low inventory costs to avoid stock out. The stock-out is the position when the retailers do not have stock in store, which means loss of sales and loss of a customer. Implementing the SC strategies helps to avoid stock out position. In web shopping, the service level plays a significant role, in online business customers have more choices and a short time to switch over, the fully synchronized supply chain is essential to keep a high level of services, means speedy and accurate respond the customer query and to fulfill the customers demand and keep the whole supply chain updated about the new demand in market and the inventory position and all other costs.

1.5 Purpose Of The Study

This thesis's scope includes understanding the warehouse operation in dual distribution like retail and e-tail distribution, how the different factors increase the cost when single warehouse a has dual distribution operations like B2B (the physical stores) and the B2C (Business to consumer) e-commerce retail the online store?. Further, the research aim is to find the warehouse's cost drivers and the difference in these drivers. In order to accomplish this, warehouse cost data will be collected of two different warehouses of 2 years, so a quantified analysis could be conducted to compare the cost drivers in two different years. Through the analysis, knowledge could be extracted about how E-commerce has affected warehouse operations and potential areas of improvement to minimize the inventory cost.

1.6 Research Questions

To accomplish our research, to find the cost driver in dual channel distribution warehouse we establish the below research questions according to our best knowledge.

1- *What are the major cost drivers to be identified in dual channel distribution (in retails and e-tail)?*

The purpose of the first question is to identify what factors are involved in increasing the inventory cost, mainly when one firm uses both channels of distribution—the offline like a physical and online store.

2- *Which factor or factors are most important to influence the increase in cost of Inventory?*

Here the purpose of finding the factor having more influence on increasing the cost of inventory like labor, holding cost or ordering cost, warehousing operational cost, warehouse space cost, machinery and tools cost and maintenance cost or any other.

In the thesis, all the research questions have been addressed, and the analytics gained are used to solve the issues. In conclusion, the method(s) drawn to meet the requirements.

1.7 Structure Of The Thesis

The thesis work is written in a research-based format. The first chapter is an introduction consist of background of the topic what is the web shopping and how big the opportunity and warehouse challenges for retailer to convert the approach from retail to e tail. We also discuss the scope and the global trends, research purpose, research question. The second chapter is about the literature review of the cost drivers to the inventory where we write the factors from the theoretical framework of dual distribution warehouse. The third chapter presents the case description, where the companies and their operations will be introduced. The fourth chapter comprises about the methodology and its description. The next chapter is about the data collection and data analysis. In final chapter the conclusion the summary of the thesis, followed by managerial implications, limitations, and areas of further research.

2 Literature Review

This chapter describes the traditional way how the logistics analysts describes and do some research about the cost driver in dual channel warehouse, and how they make a different

assumption and results from the most critical cost driver, especially in dual channel distribution.

1.1 Background

More and more companies are currently interested in online business; the Internet is one of the tools for improving business efficiency. Today, decisions on e-commerce are increasingly not treated as a competitive advantage, but as a necessity, it helps avoid delays. The online industry is an integral aspect of corporate success and will produce significantly increased client sales and value-added chain. In the business processes, the majority of e-commerce implementing decisions are based on the potential to achieve significant cost-effectiveness that means greater profitability in the enterprise and higher competitiveness on the market.

Most of the companies want to be competitive in the market, and they are working to increase their output by increase the products and services or to minimize their costs. To increase their output and numbers of customers, they are using different channels of distribution like physical stores and online stores. The best survival is that which offers both services, and that is why almost all industries are focusing on it like garments, sports, financial, fashion, food, even the IT and nowadays pharmaceutical industry as well are offering products and services on dual distribution. The most trading products of online selling are the garments, fashion, books and electronics.

One of the major part of costs is the inventory cost, and the biggest question is why inventory costs in the web sector increases. The complexity of decision making in E-commerce is the explanation for this problem that affects various business processes and higher cost, which also based on the organization's structure. The more complicated the systems, the more dynamic the production and the supply chain becomes likely.

Here the new challenge is to minimize the cost of doing business and offer competitive products and services in online business. Most of the online retailers are facing problems such as demand variation, reverse logistics, seasonal fluctuations, and stock out in manage the inventory. Because of this, the risk associated with this is the loss of sale, loss of a customer, lower customer satisfaction, longer lead time, stochastic demand, high inventory cost, and many more.

There is much work done by different authors about the reasons for high cost in Inventory like inventory holding cost, ordering cost, warehouse size, inventory management, ordering size & quantity, reordering point, distribution system, and process mapping. Below we will

discuss the factors discussed and how the authors think they are essential drivers for the cost to inventory. As the all inventory are handle and distribute from the warehouse, so warehouse plays vital role in any business, in fact the success and failure of any business in depends how efficient the warehouse, how it works, structure, operations and warehouse management. Now companies are investing a big amount of budget to make their warehouse efficient. Before explaining the main cost factors, it is important to explain the role of warehouse and the warehouse operation in dual channel distribution. That makes the better understanding about the cost drivers which effect on inventory in dual distribution.

2.1   Warehouse And The Role Of The Warehouse In Dual Distribution

Warehouse is the important part of the supply chain of any business. The supply chain relies on the warehouse to distribute the product in quantity as per the requirement of order(Richards 2017). To accomplish this, the warehouse needs to ensure that value-adding activities like pricing, kitting, customized packaging, and labeling(Gu, Goetschalckx, and McGinnis 2007) are done correctly to meet the deadline. Finally, the warehouse operations need to be done cost-efficiently to create value out of the invested money (Richards 2017). It is also essential that the warehouse holds a buffer of items to meet variation in, for example, product seasonality and product demand(Gu, Goetschalckx, and McGinnis 2007). For many businesses, holding inventory is considered to be the most significant asset on the balance sheet. The average cost of inventory in the United States is more than 35% of its value (Jacobs, Chase, and Aquilano 2004).(Lambert, Stock, and Ellram 1998) lists several reasons for holding inventory at a warehouse and its contribution to the business operations:
• Attain Transportation economies.
• Attain manufacturing economies.
• Get benefit of quantity purchase discounts and forward-buys.
• Uphold the source of supply.
• Support the policies of customer service.
• Meet the requirement market condition. (e.g., seasonality, demand fluctuations, competition).
• Control the time and space complexity between consumers and producers.
• Achieve an optimum level of logistic management with least total cost logistics commensuration
• Support the JIT service of suppliers and customers

• Provide a mix of products for customers.

• Provide the temporary stowage for goods which later disposed of or recycled.

According to (Richards 2017)there has been a change in warehouses and their operations based on several reasons: The exponential rise of E-commerce, and the trend of omni channel shopping, western manufacturing in the Far East. The warehouse managers are faced with the challenge of increasing productivity and accuracy, reduce costs, Inventory, and at the same time, improve customer service (Richards 2017).

In today's business, the warehouse sustains its importance in the modern supply chain. It plays a vital role in the success of the new supply chain (Frazelle and Frazelle 2002). Many companies determined the possible solutions of synchronized the direction supply-to-customer; there are also many conditions in which direct supply-to-customer could not work efficiently because the supplier lead-time cannot reduce the cost-efficiency. So, these customer requirements should be fulfilled from the store inventory(Harrison and Van Hoek 2008). It is the same as that, in some situations, it is beneficial to have strategic inventory at the point of decoupling. It separates the lean production activities from agile (downstream) feedback to the volatile markets. As an alternative, distribution and supply networks might be complex enough to have a consolidated inventory at the holding points so that the multiple orders could be delivered i-e at break-bulk or make bulk at warehouse (Harrison and Van Hoek 2008). The process of these types of warehouses is comparatively more complex to provide high-quality customer services. The large section of warehouses that provide services at same day or next day to customers from already have Inventory, and these warehouses need to attain the reliability level with speed orientation as well as damages(Baker and Canessa 2009).

Moreover, the traditional role to hold the inventory, the warehouse has been acting as the point where goods directly move from inward to outward vehicles without a store in inventory(cross -docking) and the center for value-added services such as packing, labeling the products according to the customer requirements, warehouse also play a role of small production like the postponement point where the specific goods are assembled according to customer demand so that small generic rang of the product can hold in inventory. The center for good returns or centers for other miscellaneous activities like repaired, or end of life goods(dispose of) (Maltz and DeHoratius 2004)**.** Whereas the operation of warehouses in a wide range of custom services activities. These sustain their significance in the context of its cost. Facts tell the in the USA the capital cost on warehouses represent more than 22% of overall logistics expense, other statistics show that in the similar cost reach more than

25% in Europe (Baker and Canessa 2009)). The online sale stores also have many challenges in delivery and logistics management, like massive volumes of minimal order and short lead time with 24 to 48 hours delivery time as well as the packing and picking process even for a single order. These and many other challenges could be faced as compared to conventional business. The warehouses should be ready to provide orders that come from both physical and online shopping stores. The typical warehouse designed for the only physical store and cannot handle multiple channels of the business environment. For instance, warehouse workers cannot utilize in the operation of online orders (Caudell 2015). In this era of digitalization, the warehouses must be able to have interconnectivity and multi-purpose infrastructure for sharing useful information and handle the different orders come from the different channels of the business environment; such a warehouse can deliver value-added services as well. (Alawneh and Zhang 2018, Graves 2012). Decentralized and centralize policies are two strategies to fulfill the process and having the capacity to handle multi-channel business environments. The company has a decentralized policy for warehouse, establish a separate e-warehouse, and manage the online sale separately. In these warehouses, each sale channel has separate concerns and sometimes the results in inefficiency(Bendoly 2004, Zhang et al. 2010, Hübner, Holzapfel, and Kuhn 2015a). Other than the profit concerns, these companies run lack of coordination between channels, which come up as the result of inefficiency(Zhang et al. 2010). The counter strategy of the decentralized warehouse is centralized warehouses that are a connected and integrated warehouse with a cluster of all facilities at a single unit. The clusters are quite able to entertain the orders from all possible channels such as online or physical stores (Agatz, Fleischmann, and Van Nunen 2008, Hübner, Holzapfel, and Kuhn 2015a). The popularity of the centralized policy for warehouses increases, making all firms adopt its warehouse. International Business Machine Corporation, Hewlett-Packard and pioneer corporation, Hamilton beach and Nike are some of these firms (Huang, Yang, and Zhang 2012, Zhang and Tian 2014, Li, Zhao, and Xie 2015, Xiao and Shi 2016).The main benefit of this type of warehouses includes reducing the cost of infrastructure and managing the inventory because both channels are operated from the same unit. The integrated warehouse makes it easy to coordinate the inventories, manage the volume of orders, and provide flexibility in the delivery process. In these types of warehouses where dual channels are entertaining at the same time, there is a great challenging issue like inventory management for dual channel at the same time for offline and online retail orders, because different orders from multiple channels have different features and requirements. The main differentness occurs are the

size, quantity and lead time of the order, which must be carefully addressed to provide quality of services. Conventionally the online orders come in random patterns having unpredictable time and size as well, on the other hand, the offline retail orders placed in fixed timings and mostly in large size which is predictable easy to justified the operation capabilities of these type of warehouses (Agatz, Fleischmann, and Van Nunen 2008). These issues create hurdles in warehouses' operation and make it difficult to maintain the structure for a long time. Most of the companies that adopt the dual channel have to face the issues while managing the policy for inventory as well as the inefficiency in the way of optimal performance of firms. The reorder point or the optimal order quantity is the problem when a new sales channel is traduced the firm. Not only this, but also, they have to ready to entertain the capacity constraints, as well as the uneven demands, comes from both of the channels of the business environment. New studies focus on the dual channel for the supply chain, these have focused on the competition and management of the sales channel (Hua and Li 2008, Lu and Liu 2015, Lin 2016, Wang, Malluhi, and Khan 2016, Chen and Chen 2017). In another study, the logistical challenges and processing of delivering the online orders prominent (De Koster 2003, Tetteh and Xu 2014). There is a great interaction between the service and the prices of both channel of the business environment (Yao and Liu 2005, Ryan, Sun, and Zhao 2012, Panda et al. 2015, Yan et al. 2016, Matsui 2017), and the online retail orders delivery process (Agatz, Fleischmann, and Van Nunen 2008, Mahar, Bretthauer, and Venkataramanan 2009).The management of inventory of dual supply chains has discussed (Khouja 2003, Yao et al. 2009, Zhang and Tian 2014, Zhao et al. 2016). None of these studies have focused on the cost of joint warehouses to make it operational. Thus, this study's focus to identify the influence factors on inventory in joint warehouse or the dual channel distribution the retail and the e-tail.

In inventory management, the warehouses play important roles while addressing the demands that come from both channels. The dual channel or joint warehouses have a significant in its structure. These joint warehouses divided into two different regions, one of them dedicated to the online orders with different sizes and time, as shown below. The firms that used the centralized policy for warehouses utilize by the manufacturers, retailers, and even third-party logistics in the signal unit. A similar structure found in e-commerce firms that only can address the order comes online form customers (Xu 2005).
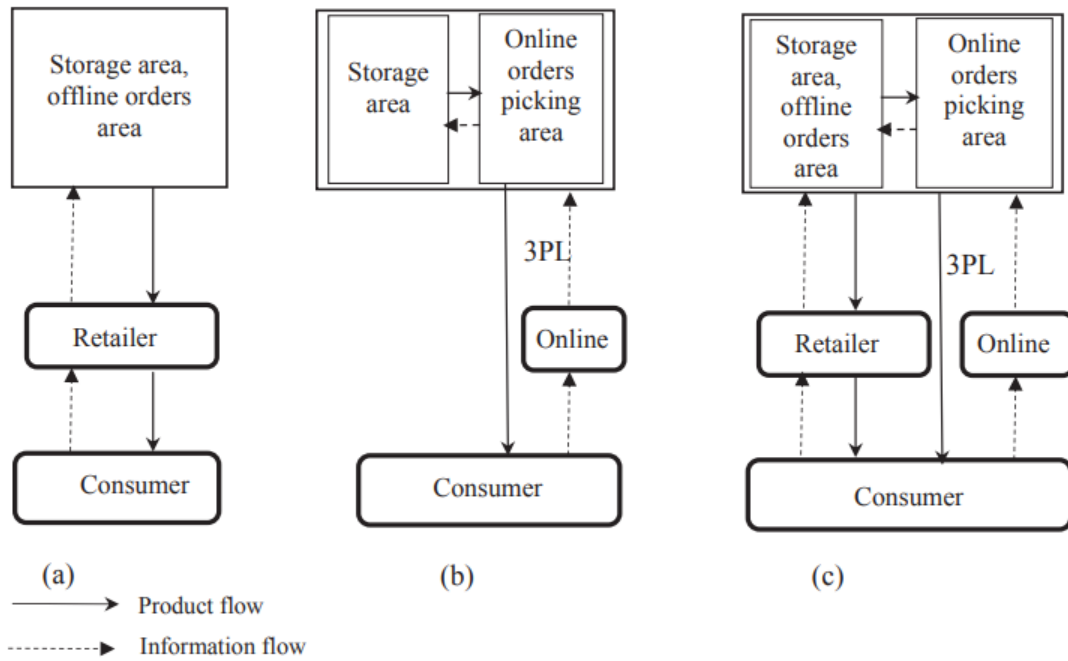
Figure 5: *(a)–(b) Single-channel warehouses and (c) dual-channel warehouses(Alawneh and Zhang 2018)*

In Figure 1, there is a comparison shown between the dual channel warehouse and congenitally designed warehouse for the e-commerce firm. The dual channel warehouses have two regions to address the orders (online orders and retail orders). The main aim of this study to understand the factors that increase the cost of inventory when the structure of warehouse having the capacity to handle dual channel distribution, that how the dual channel warehouses fulfill the need of dual-distribution that will reduce the cost and increase the capacity to handle the uncertain orders as well as the demands in such a way that the total cost will be minimized, so it is necessary to understand the structure and operation of dual warehouse. To design an appropriate structure with centralized warehouse policy is not an easy task in the operation of warehouses to handle the orders for dual channel. From the logistical perspective, it is familiar to use a modern warehouse layout with sub-sections, and each section is responsible for addressing each customer platform (Caudell 2015). In 2017, it was declared one of the most efficient practice for a warehouse in to have multi-purpose facilities which can handle all size of orders as well as perform specific operational tasks (Richards 2017). The joint warehouse with centralized policy brings a new paradigm shift in the delivery process of E-commerce with efficient and performance-oriented design. For large orders that consume much space, have different and separate warehouses to have better access for maintenance, because locomotion of heavy and bulky products (refrigerator and furniture) is tricky in different areas of the signal warehouse. A dedicated e-fulfillment

warehouse performs better delivery assistance as well as provides reduce in operational cost. The dual channel warehouse shows optimum performance for electronics, grocery stores, and departmental stores, clothes and shoes because it provides a flexible solution for small order in high volume.

2.2 Cost Drivers From Literature

2.2.1 Literature About The Warehouse-Size

The study discusses how the inventory cost increase in dual channel distribution. Sales are generated from both channels like B2B and B2C, i-e one channel of sale generation is physical stores of the firm and other is e-tail via web, and to manage this stochastic sales some companies use the same policy to handle this new sale which usually becomes the reason of failure to meet the customer expectation in respect to packing, lead time and quality, service level, any many other reasons due to their slow operational process and high cost, they do not remain competitive in the market and lose their customer and business.

Numerous investigations and studies have been reported out together with specific applications in the area of warehousing. While none of the innovative research channels have focused on warehouse space allocation cost in dual warehouse, whereas contemplating the warehouse's multi-channel distribution in respect of production facilities and efficiency, according to(Goh, Jihong, and Chung-Piaw 2001) analysis of warehouse size to reduce production and storage expenses as the key objective, (Goh, Jihong, and Chung-Piaw 2001) mitigate this issue by characterizing warehouse costs as a piece linear function which always signifies that different size warehouses possess different cost structures and that a warehouse 's size (or building area) is a significant cost factor.

According to the (Richards 2017), Space costs are indeed the quintessential costs associated with warehouse management, includes building/land lease costs and building amortization (depending on whether on the building and land are purchased); insurance; premiums or local authority revenue; electricity and telecommunications expenses; installations and connectors deterioration; racking devaluation; refrigeration system depreciation; Maintenance and repairs; maintenance, protection, depreciation of other building equipment; managing waste.

Labor salaries (fixed) for workers in warehouses include on-cost pay, skilled insurance; protective apparel (PPE); welfare; and instruction. Indirect jobs (fixed) administration of storage, including administrative and operational personnel, wages like on-cost, benefits,

protective gear (PPE), social aid, instruction. Working overtime (variable), incentives. Equipment (fixed) depreciation / lease / rental expenses.

Running costs (variable) of equipment, e.g., gasoline, tires, lubricants, batteries, packaging, pallets, stretch wrap. Overhead expenses (management, accounting, human resources, IT and administration): income as well as on-cost plus in-kind incentives also including cell phones, commuting, etc. company cars and running costs; office machinery and appliances depreciation/lease / rental costs; information technology costs (hardware and software). Overhead expenses (sales and marketing in 3PLs) wages and on-cost plus in-kind advantages such as mobile phones, and lodging, etc. company cars and running costs; marketing expenses, such as marketing campaigns, displays, and adverts, etc.

Different costs of communication; postage; bank charges and payment interests, funding costs/finance costs; health, legal and professional fees as well as audit fees. In addition to wages and salaries, gross production costs involve welfare contributions from employers (including social security contributions and pensions, charged on behalf of the employee) and other non-wage costs including costs of disability, pregnancy, and maternity, costs of professional training and recruiting and other incentives in kind that might contribute.

To summarized all above cost (Richards 2017) presented a cost tree as per figure below, he differentiates the cost into three main cost elements in warehousing like storage cost, handling, and overhead costs, which further he divided into some direct expenses effect on the cost of the inventory and to the total cost. The cost-tree reflects different levels of detail, in addition to having a precise analysis of the possible costs of warehouse facial features. The relatively high level of detail, the more accurate an estimate will be, and the more time it will cost to pursue one such estimate.
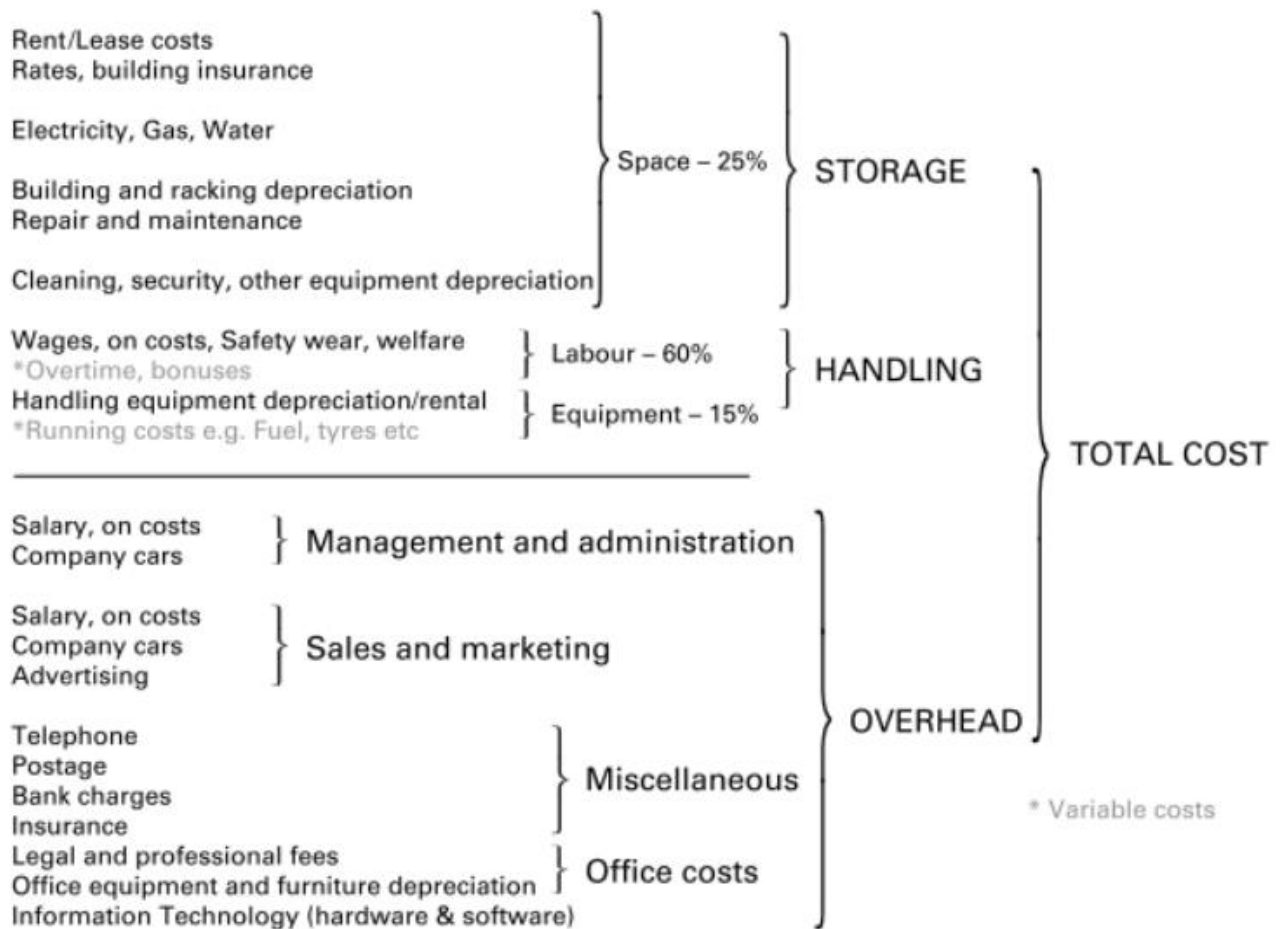
Figure 6: The outflow of cost breakage is shown in the figure (Richards 2017)

In addition, the expense breakup tree indicates the ratio per attribute of which labor accounts for most of the storage and handling costs with 60% followed by the cost of space and facilities of 15-25%, respectively, of the overall cost of storage and handling. The cost-tree does not provide the overhead ratio with respect to the overall prices. The most common variable / fixed cost ratio is 60/40, according to many experts, but the exact ratio is highly dependent on the sector and customer that is being dealt with(Richards 2017).

To summarize this, the components with the highest cost are:

- ❖ Labor
- ❖ Space
- ❖ Equipment
- ❖ Overhead

Building costs formulated by using the installation costs per square feet and height, a consumption parameter, and the total construction area required.

Equipment costs the first appropriate number of pieces of equipment is estimated and use the manufacturer 's desired frequency of handling, and the actual distance traveled withing warehouse. The estimated cost of equipment would then be accumulated, considering the number of the equipment parts includes the cost of the associated conveyer belt and the expense of the monitoring system.

According to the researcher, labor costs are the number of employees required for the preparation of the product (so not on the actual throughput). In their formulation, these costs get corrected for inflation. This comprehensive method of modeling the cost of the warehouse is beyond the scope of this thesis, but this design can be extracted from the significant cost drivers. The property, construction, and maintenance costs are determined primarily by the cumulative proposed building needed area for the warehouse and state (or region) details, including such land costs or cost of maintenance. The costs of machinery, service, and labor are both determined by the type of product and the amount thereof, as the choice of machinery and the number of employees are dependent upon various factors. These all cost factors vary from country to country like lease agreements, rent charges, and the wages of employee. Despite being formulated differently, the cost formulations presented in this report are all driven by the throughput and the warehouse size. Additional expense drivers are the state or area where the warehouse is installed as well as the product category because of behavioral product factors space utilization as well as the option of appliances.

2.2.2 Inventory Holding(storage) In Dual Channel Supply Chains

According to(Chiang and Monahan 2005), inventory level increased at both ends at the manufacturer and retailers level when demand is generated from different channels. The stocked based inventory is used to avoid stock out a position as loss of sale is costly for companies. This stocked based inventory also helps to reduce the operating cost as well.(Teimory, Mirzahosseinian, and Kaboli 2008) purposed to separate both the channels lost sale cost and developed two algorithms. One was a simulated annealing method, and the second one was based on a neighborhood concept. In 2011 (Takahashi et al. 2011) considered setup costs for both order production and order delivery. They proposed an inventory control strategy with the objective of minimize the inventory holding cost, lost sale cost, and production and delivery cost he purposed a model.

The (Boyaci 2005) also continued to work on Manage the inventory with dual channel distribution networks while analyzing the levels of inventory of a distributor and a double-

marginalized manufacturer; The author found that the manufacturer managed to excess stock as the double oppression continued to increase while the retailer managed to be out of stock. In addition, (Geng and Mallik 2007) were researching inventory competition between a manufacturer-owned direct online channel and an offline retail channel. They attempted to claim that as capacity increases, the profit from a dual channel supply chain would boost. In addition, researcher (Hoseininia et al. 2013) have examined the rivalry which emerged across broadcasts; they focused conceptual method on a system of Stackelberg. Researchers examined the degree of inventories and their link to the cost of production and retail prices. In addition, (Schneider and Klabjan 2013) examined dual channel revenue management by evaluating the circumstances and consequences of channel-specific pricing offerings. They also investigated the requisite conditions for active dual channel. Manage the inventory strategies with platform-dependent selling prices (Alawneh and Zhang 2018).

2.2.3 Warehouse Operations and Management In Dual Channel Supply Chains

The research on dual channel warehouse operations shows how important operational procedures are, specifically with respect to strategies for direct channel fulfillment. (Hübner, Holzapfel, and Kuhn 2015a) analyzed multi-channel retailing operating frameworks comprising network architecture, the inventory management, warehouse operations, and production schedules. According to them the most integrate warehouse operations are main factors in multi -channel operation (Alawneh and Zhang 2018). Related to the dual channel warehouse in terms of warehouse size and space, the forward or-reserve challenge has been established in previous research since. (Hackman, Rosenblatt, and Olin 1990) created a model to decide the items to allocate to an automated material handling system (AS / RS), where the warehouse was grouped into different regions: the AS / RS zone and the manual or semi-automated material handling system region (Alawneh and Zhang 2018).

It is known that the e-commerce industry has been using the "multi-channel warehouse" for many decades, but only a few publications can be presented in the literature about such a warehouse, such as those by (Hübner, Holzapfel, and Kuhn 2015b). In addition, almost none of these articles provided the multi-channel warehouse with a quantitative analysis. A literature review indicates that many conceptual management models for dual-channel supply chains were developed; however, work into warehouse design, processes, and capability in the two-channel context is missing. Capacity management and operations of

Single-channel warehouse was discussed by some researcher in literature but there is not enough work on dual channel operations and capacity management. Thus, the control of the production, distribution layout, processes, and resources control for an optimized dual channel model has not been implemented to the best of the experience in Dual-channel warehouse distribution (Alawneh and Zhang 2018).

2.2.4 Channel Integration

As (Swaminathan and Tayur 2003) the significant changes established a need to contend with systems of e-commerce execution in a conventional distribution chain. Following a thorough literature review, they confirmed that channel integration for a dual channel supply chain tends to increase advantages, significantly reduces inventory, and increases customer satisfaction. Nevertheless, the models studied within their paper focused primarily on electronic commerce. Therefore, no clarification of double-channel activities and their interconnections has been given. A further primary supply management research was performed in a world of electronic commerce (Agatz, Fleischmann, and Van Nunen 2008). Researcher's focused on topics related to logistics network design, warehouse architecture, supply chain management, and capacity management. The authors divided the dual channel fulfilment process into consolidated execution (using one warehouse to meet the demands of various channels of distribution) and determined output (using a single warehouse for multiple channels) and specific execution (use specific warehouse for multi-channel). The most preferred warehouse network in dual channel is the integrated fulfillment (using one warehouse to fulfill the demand of multi-channel sales like from retail and e-tail at same time) (Alawneh and Zhang 2018). A new strategy for inventory to online-to-offline approach proposed by (Zhao et al. 2016). They were proposing the double-channel distribution network of one producer and one seller. They also suggested a consolidated, decentralized and centralized model of inventory either with or without cross transshipment. In their framework, the decision variables were stock level for the store and transshipment price; however, no ordering or holding costs were considered. They did not, however, acknowledge the dual channel warehouse, nor even the expenses of purchasing and keeping. (Zhang and Tian 2014) researched with one supplier a dual channel supply chain, which markets goods through a direct channel and a retailer. They developed a single-period model of profit-sharing between producers and retailers. The model parameters were direct and retailer's channel immediately applicable with a retailer service problem. However, they did

not find either the dual channel warehouse or the running costs. (Yao et al. 2009) studied a dual channel supply chain with one supplier and one retailer. They investigated a centralized strategy for inventory, the inventory strategy for Stackelberg, and the strategy for 3PL e-tail operation. They introduced a single-period model to achieve the quantity of supply for the supplier and the seller, optimizing the anticipated benefit. They did not have to deal with the dual channel warehouse either in terms of design or organizational levels, however. Inventory at two-echelon is also the reason for the increase in Inventory cost: the upper echelon Manufacture and the retailer lower echelon. In most cases, the online customer prefers to contact the upper echelon manufacture, so the manufacturer keeps the Inventory. Research continue on the inventory holding cost at multi-level and (Khouja 2003) suggested a framework of the three-stage, supplier, manufacturing company and customer supply chain. They implemented a set of policies of periodic inventory analysis and defined modalities for stock control collaboration, such as number of orders and the cycle time. However, the warehouse structure and the operational of dual channel warehouse did not consider (Alawneh and Zhang 2018).

2.2.5 Dual Channel Retailing

In literature the word multi, cross or dual channel retailing are used interchangeably. According to (Beck and Rygl 2015) point out this problem where these terms are used interchangeably. In research, the focus has been on multi-channel retailing, and less research has been done on cross- and omni channel retailing. Also, cross-channel can, in some research, is referred to as multi-channel. Under a clarification of the terms multi-, cross- and omni channel will be given. Multi-channel can be referred to as retailers that sell their products through more than one channel like retail and e-tail. This can be, for example, through a physical store and an online store. Multi-channel retailing does not provide an interaction across all the channels. In some businesses, the organization is separated for each channel. The reason for this can be that the information systems can differ from physical and online stores (Levy, 2012). In contrast to the term multi-channel retailing, cross-channel retailing makes it possible for customers to generate channel interaction. Also, the retailer can control parts of or full integration of two or more channels(Beck and Rygl 2015). Omni-channel retailing refers to the use of multiple channels to interact with the consumers and fulfill their orders (Chopra and Meindl 2007). In omni channel retail, all paths through the supply chain are connected wherever possible. A positive impact of the use of this channel

is that businesses can share facilities and inventories. It may also impact customer satisfaction and reduce costs. When introducing omni channel to the business, it is important that all channels are connected and complements each other (Christopher 2016). In omni channel retailing, the customer can search for information on a product both online and by visiting the physical store. The customer can thereby get an enhanced insight about the product and may evaluate the alternatives before deciding to purchase (Bernon, Cullen, and Gorst 2016). (Beck and Rygl 2015) made a categorization tree based on their findings, that illustrates the concept, making it easier to grasp
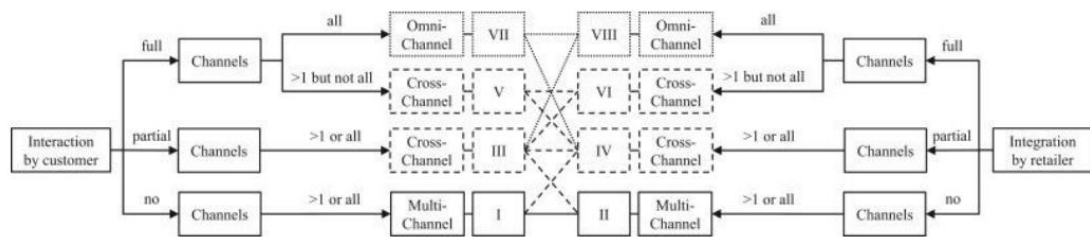

Figure 7: Categorization tree in Multi-, Cross-, and Omni-Channel Retailing for retailers and retailing(Beck and Rygl 2015).

Dual channel is also used in research done on traditional and online retail. A dual channel can be considered as a business that uses more than one channels to sell a product to the end customer. This is often done through traditional retail (e.g., physical store, showroom) and online retail (Ryan, Sun, and Zhao 2012). Since the terms are used interchangeably in the literature, research done on multi-, cross, and omni channel retailing will be used in this study. Also, research done on dual channel retailing will be relevant.

2.2.6 Challenges With Having Multiple Channels

The trends in the market and technological developments have had a strong impact on warehouse operations. However, there has not been done much research on the challenges and opportunities the retailers are facing. According to (Kembro, Norrman, and Eriksson 2018), the research done on challenges with transition from multi-channel to omnichannel is mainly conducted by one research group (Wollenburg et al. 2018, Mena et al. 2016). The introduction of E-commerce has led to shorter response times with smaller and more frequent deliveries. These services, including others, are something customers are starting to expect from companies. However, they do not want to pay the real cost for the services (LIEB 2018). Research identifies increasing challenges for retailers that go from a single channel to multiple channels. The research focuses on the higher need for efficiency and

flexibility in the warehouse by redesigning the warehouse and distribution(Wollenburg et al. 2018, Agatz, Fleischmann, and Van Nunen 2008, Hübner, Holzapfel, and Kuhn 2015a). More specifically, the introduction of an omni channel and seamless shopping experience for the customer may cause challenges for returns, processes, information systems, inventories, and performance measurement systems (Bernon, Cullen, and Gorst 2016). The traditional retailer's warehouse is significantly impacted by seasonal demand fluctuations, where it affects the decision on order quantities, shelf space, and pricing in a store (Agatz, Fleischmann, and Van Nunen 2008). The warehouse manager is faced with the challenge of a variety of staff demand and equipment during the season (Richards 2017). Further, demand fluctuation tends to have a stronger impact on one-tail and affects, among other things, the delivery capacity utilization (Agatz, Fleischmann, and Van Nunen 2008). A big challenge for warehouse operations is to combine the handling of small customers online and store deliveries in a way that is time and cost-efficient(Hübner, Holzapfel, and Kuhn 2015a). The warehouse may have a large assortment of goods stored with different values. Thereby, the low-cost items use the same amount of labor and equipment as high-cost items, which creates a significant difference in margins (Richards 2017). Another challenge is addressed by (Kozlenkova et al. 2015), where the costs will be different depending on which channel the customer chooses. A supply chain may not be optimal for both channels. The authors state that the cost of warehouse, merchandising, and transportation processes will differ depending on the channel. The retailers that recently became multichannel retailers tend to have separated inventories and picking processes based on channel. However, with the experience of having multiple channels, retailers are pursuing an integration of warehouses and inventories, which is predicted to have a positive effect (Mena et al. 2016). Through the integration of inventories, warehouse operations, organizational units, and IT systems, companies can take benefit of the synergies in sales, organization, and logistics between the channels (Hübner, Holzapfel, and Kuhn 2015a).

As noted, all the research above work on different aspects of warehouse some use single warehouse some dual distribution but none of them focus on the strategy to minimize the inventory cost of the dual channel distribution system. Mostly their treatment to the manufacturer's warehouse without researching the consequences for the dual channel warehouse system and processes that the online distribution capacity has. In addition, they did not find the, capacities of the dual channel warehouse, the structure of the warehouse in respect to the size and layout they also did not consider the warehouse operation and management in dual channel of distribution. There is limited work on the warehouse costing

and they did not proper discuss all factors that contribute towards inventory cost in dual channel distribution in.

3 Case Description

In our research we collect the data from the two different companies of two different nature of business. Both of the company's warehouses are located in Oslo Norway. Both companies have dual distribution channel of business like the physical store in the different locations of the Norway almost in every big city of the Norway and both are also operating the online store for online customers. Our research is only for the purpose of calculating the cost drivers to the inventory in retailers with multiple channels. This means that the warehouse costs contribute to total cost of companies having physical stores as well as an online. The companies will be given fictious names as Company 1 and Company 2, hereafter referred to as C1 and C2 respectively.

Both the C1 and C2 have almost similar nature of warehouse in terms of functions and operations. Like receiving of the stock from import and local manufactures, depalletizing of goods and the moving of goods according to their rack location, then after the packing area, order picking area, shipping area and the cross docking. However, both companies have different approaches in operational procedures, warehouse size, the number of employees, and the number of orders handled per day differs there is also a difference in equipment of handling, their tools and automated system are also different. Separated activities are performed in both warehouses like for retails and for online customers. C1 has dedicated separate department to deal with online stores and online customers, whereas in C2 same warehouse and same dispatch department for both distributions and all stock and goods are dispatched directly from here. Both companies offer direct home delivery and order pick from their different nearest stores for their online customers and to collect the returns of goods in stores nearest to the customer. This chapter will give a brief description of the companies in the below section.

3.1 Company 1

C1 works with the textile garment's apparels business such as curtains, kitchen, bathrooms, home interior, bedroom like bedsheets and pillow and other kind of fabric. They are one of the pioneers in textile business, having presence about more than 60 years of experience in the business. The company's 150 store cross all over the country focuses environment

protection and safe products for the whole family and is a large actor in the interior and home textile segment. On the financial side in 2018 their revenue was around 897 million NOK. In 2010, C1 planed and expanded online retails although in first there was not big difference in sales due to e-tail but for later on there was positive responses from customer, which actually increase company outreach and customer base. The online store stands for 9% percent of the total revenue, and the company expects more growth in coming year as this create ease for the customer. The company has 1066 employees, and around 30 permanent and some seasonal and temporary employee work in the company's warehouse. The head office and warehouse are placed in the same location and is around 9,500 square meters in total. C1 offer pick-up and returns of the goods even after 30 days of purchase at store services in all the physical stores of respective locations, that enabling online shoppers to collect and return their goods in the nearest store. All products bought online could also be shipped directly to their home delivery, there are some rule and regulation like minimum amount for home delivery or fast delivery via paid services some are free of cost shipping within Norway. C1 has a broad of products in all categories and need more space and allocated racks and space in warehouse. C1 use latest machinery in warehouse for pick up orders for both channels. 3PL is used for direct home delivery and own and some contractual transportation is used to refurnished weekly deliveries to own stores.

3.2   Company 2

C2 is one of the largest and fastest growing sports retailers by revenue in the Nordic region. C2 sport retail chain, with stores and E-commerce in Scandinavia. The C2 has headquarter is in Oslo (Norway), By year end 2018 C2 had 36 stores in Norway, C2 has 3,220 employees (group employee incl. full- and part time,) at year end 2018. C2 opened its first store in central Oslo in 2001 and online store in 2002. C2's main objective is to be the leading distribution channel for branded sporting goods. C2 offers a unique customer proposition through a wide range of high-quality branded products, combined with strong focus on customer service and a clear pricing strategy. C2's vision is to be the paradise for people interested in sports, outdoors and wildlife and the mission is to be a leading European sports retailer for branded sports, outdoors and wilderness products at the best prices.

The strategic focus is to create value to the shareholders and the community through capitalizing on further growth and improve the efficiency of the operations. The revenue of the C2 for the year of 2018 is 4,642 million NOK from Norway stores. In 2018 C2 E-

commerce growth was recorded as 38% from previous years. In 2018 C2 has 36 physical stores in operation and plan to open 4 new stores in 2019.

C2 believes it is in a strong position to build a true multichannel platform offering a broad range of branded goods at the lowest price, providing valued customer service across all channels. A multichannel platform provides a high degree of flexibility for the customers. In 2018 C2 rolled out a new omni-channel stock solution in all markets, making all stock available at all channels at all times. Omni-channel is in a strong position to build a true omni-channel platform offering a broad range of branded goods at the lowest price, providing valued customer service across all channels. With state of the art logistics and IT-systems, as well as an experienced and efficient purchasing team with strong supplier relationships, C2 has a robust backbone structure to support both the E-commerce operations and the physical stores. C2 continuously working on strengthening the omni-channel offering to drive visitors and transactions. The revenue contribution from E-commerce for the Group in 2018 corresponded to 16.3 per cent.

C2 strives to be best-in-class in operating efficiency through efficient operation of the stores, warehouses, logistics and head office. C2 believes of the products The large stores allow for economies of scale and high efficiency in terms of effective sourcing, purchasing and distribution, store operations, logistics and headquarter resources required to support the stores fewer and larger stores, in combination with centralized purchasing and warehouse functions, result in maximized logistical efficiency and minimized corporate support expenses.

C2 introduced pick-up at store services in all the physical stores of the Group, enabling online shoppers to retrieve their goods in the nearest store. All products bought online could also be returned in the stores. C2 look at all stores as local warehouses, always closer to the customer than a pure online offering. The Group has two central warehouses, one at Gardermoen Norway (outside EU) of almost more than 10,000 square meter and one in Õrebro Sweden (inside EU). The Norwegian warehouse serves the Norwegian market. In addition, C2 has developed customized order packing and shipping processes tailored to meet the specific requirements of the E-commerce business.

C2 exercises tight control over store-level expenses, central warehouse expenses, real estate costs and corporate overhead. C2 has a controlled value chain, efficient logistics, centralized purchasing and a fully integrated IT system resulting in a low-cost operating structure. Central purchasing and distribution functions to manage inventory planning, allocate flow of goods to the stores and oversee the replenishment of goods to the central warehouses.

C2 has the central inventory management system performs continuous in-store inventory checks and redefines the minmax levels when needed to achieve the high inventory turnover and optimal in-store inventory level. C2 use third party transport providers to deliver stock to the warehouses and stores with one day delivery from the central warehouse to most of the stores and E-commerce delivery points.

3.3 Difference Between Retail And e-tail Orders

While speaking with the businesses, the predominant differences between retail and e-tail orders have been illuminated. In retail, the warehouse customer is the physical store owned by the company whereas in e-tail the end user is the customer. There is more chance of returns of goods from end customer in e-tail distribution as there are some new customers and some are well renown and loyal repeated customers while in retail stores are the know customers of the warehouse.

In e-tails business there are larger numbers of small orders from different customers with different address and location so mostly online store use the 3rd party logistics and offer the free and paid delivery. Some online stores offer delivery in 24 to 72 business working hours. While in retails business the stores give the big orders to the warehouse and depends on the sale volume store get regular delivery from warehouse of the ordered quantity. In most cases these deliveries are furnished by company's own transport. For the companies, order picking is usually done in batches for the stores while the order picking for the end-customer is done in pieces. So, there is also a difference in packing for both customers. For retail, the deliveries are typically sent on pallets to stores while under e-tail the orders are sent in packages to either the companies store or to the end-customer's by 3PL.

4   Research Methodology

The research methodology of the study has been discussed in this chapter. The methodology is the process for the collection of data and research designs that help to analyze the overall data and information that is necessary to solve the research problem utilizing scientific methods. As (Saunders, Lewis, and Thornhill 2009), referred the terminology as "methodology," according to which the researcher has received guidelines for research undertaken process.

4.1   Research Philosophies

Research philosophy is a belief in the way data is being collected, analyzed, and used. The research framework that you are following includes essential premises about the interpretation of the world. The generalizations will reinforce your research design and methodology; then, you can choose as part of an overall strategy (Saunders, Lewis, and Thornhill 2009) which is shown in the figure below, research can be like an onion that needs to strip away when we go through each iteration.
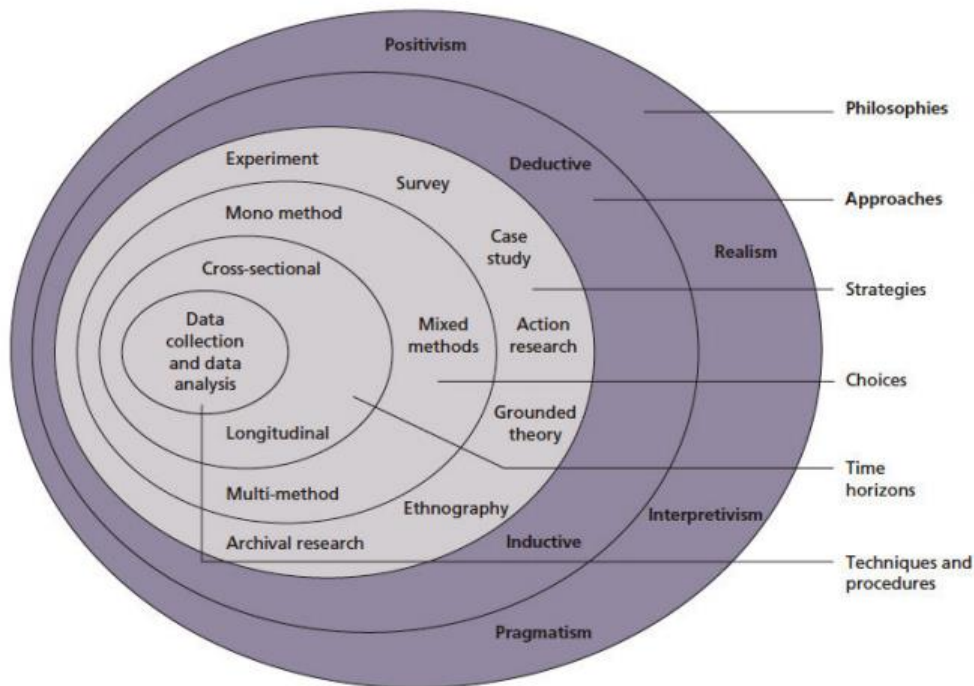

.

Figure 8: Source (Saunders, Lewis, and Thornhill 2009)

According to Saunders, there are three main dimensions of research philosophies:

• Ontology

• Epistemology

• Axiology

 Ontology refers to the branch of philosophy that is based on nature of reality and structure of the world, directing to specify the form and nature of reality and question what the reality is (Wand and Weber 1993). Ontology is classified on the basis of:

• Objectivism

• Subjectivism

Objectivism describes the view that social forces do function outside the social actors interacting regarding the existence in reality. For example, a large firm chooses to replace all of the employees of every specific department. In this case, the administration is an impartial entity, and they decide to take an objectivistic approach to the analysis of a particular company. The second dimension is Subjectivism; it implies it from the experiences, and the consequent behavior of such social actors interacting with their life social phenomena is generated (Saunders, Lewis, and Thornhill 2009).

Epistemology centered on the complexity of human consciousness and knowledge, which can be obtained through numerous studies and alternative methods of inquiry (Hirschheim, Klein, and Lyytinen 1995). It includes what constitutes sufficient knowledge in a research area. It can be split into two components; resource investigator and researcher feeling. The 'financial research' looks at the data from the viewpoint of research philosophy. By contrast, the 'feeling study' is concerned about the employees' perceptions and attitudes towards their supervisors. So the 'capital researcher' includes establishing positivist theory while the 'feeling researcher' focuses on the theory of perception (Chetty 2015). In the domain of research philosophy, Epistemology is therefore classified as,

• Positivism

• Realism

• Interpretivism

The metaphysical approach of natural science is stated as being as if the study of biological researchers was focused on an observable social structure. A qualitative approach works in line with observable social reality, and the end product of studies like those produced by natural and physicist physicists can also be assumptions (Remenyi et al. 1998). This is a technique that focuses on the development and theory of data collection. These hypotheses can be tested and validated for further study. In order to ease the theory, the optimistic scientist follows a tightly organized process. Positive observations and statistical analysis work accordingly(Chetty 2015). Positive observations are also evaluated

Realism seems to be another philosophical argument that pertains to research exploration. The concept of realism is that the truth is what the senses give us as reality: that things have an independent existence of the human condition. Realism 's theory is that there is a very different truth from the mind. The two dashes of realism are pure realism and conceptual realism. Critical realism depicts the world through human senses. The impressions and the

representations of things are critical realism, not the right stuff (Saunders, Lewis, and Thornhill 2009).

 The philosophy in which the researcher assumes that individuals seek comprehension of the environment in which they live and work is also known as constructivism. The research goal is to focus on the respondents' opinions, ideas, and perceptions (Creswell 2014).). It endorses the need for the researcher to understand distinctions among humans in our role as social actors. This emphasizes the difference between people conducting research and not objects such as trucks and computers. According to this definition, using the example of actors who perform a part or role in film or theatre, play their part. Likewise, we perceive our daily roles in society according to the meaning we give to these roles (Saunders, Lewis, and Thornhill 2009).

Axiology is a philosophical concept, which researches appreciate judgments. It is the social inquiry mechanism we are concerned with. The position that values play in all stages of a research project is of considerable significance if one wishes to be trustworthy or credible in their research findings(Saunders, Lewis, and Thornhill 2009).

4.2   Research Paradigm

As a researcher, its one responsibility & essential part of research methodology to choose a specific research philosophy for one's paper. This will help other who will be studying particular or comparable context in future and who might encounter those real-life obstacles. Research philosophy or Research paradigm termed by Guba, holds utmost and important belief system that guides the investigation (Guba and Lincoln 1982). "A research paradigm inherently reflects the researcher's beliefs about the world that s/he lives in and wants to live in. It constitutes the abstract beliefs and principles that shape how a researcher sees the world, and how s/he interprets and acts within that world"(Lather 1986). Therefore, paradigms are crucial because they provide belief systems and dictates that impact what should be studied for scholars in a specific domain, how it should be studied, and how the study results are interpreted. The paradigm determines the researcher's conceptual orientation, and, as we have seen in the conclusion of this paper, this has significant consequences for any action essential part of the research phase, especially methodology and method selection. And then, a model describes how meaning can be developed from the data that you collect based on your individual experiences, i.e., where they come from.

It is, therefore, essential that while writing one's thesis, one should write down the research paradigm (Kivunja and Kuyini 2017).). Several other researchers have suggested two primary taxonomies for paradigms, namely, Positivist, Interpretivist. Traditionally, a positivist approach implies a quantitative research method, whereas a constructivist or interpretivist paradigm uses a qualitative approach. This can not be true per each situation; there are examples where one may use a quantitative methodology to pursue an interpretative study (Chilisa and Kawulich 2012). The paradigm of analysis used in this study is interpretative. In interpretive research, there are no predefined dependent and independent variables, and the purpose is to examine the subjective perceptions and reflections underpinning the social action (Kaplan and Maxwell 2005). This study focuses on finding the factors that increase inventory cost in the warehouse when a centralized warehouse operates in dual distribution, the offline physical store, and the same time to fulfill the direct order from the online customers. This study is a mix of qualitative and more quantitative approaches.

4.3 Research Design

Analysis design is a strategy outlining how, where, and where to collect and evaluate the data. (Parahoo 2014). According to (Kerlinger 1986) research design is "the plan and structure of investigation so conceived as to obtain answers to research questions". It is a systematic master plan for scientific study that can have several approaches such as qualitative, quantitative or mixed methods (Creswell 2014).

4.4 Quantitative Research

Quantitative research is the analyzing of a variety of numbered data through statistical procedures, testing of variables and studying the relationships between those variables. It involves assumptions that can be tested deductively, explaining the findings that can prove the results and has a structure form of report. Survey research and experimental design are two main quantitative forms of research (Creswell 2014).

5 Data Collection

This research is carried out using data from interviews and questionnaires with the warehouse manager as a qualitative and quantitative analysis tool. For quantitative

calculation purposes, we need some financial and other data in the form amount and figures numbers. The primary data has been collected via the company's financial statistics issued in financial statements as well as other financial reports. We also seek to administer interviews by submitting questionnaires to the departmental head of the consideration by phone. Qualitative, semi-structured interviews are one of the social sciences' most influential and commonly implemented forms of data gathering (Bradford and Cullen 2012). Commonly utilized have been the research databases such as Google Scholar, ProQuest, ScienceDirect, and Education, an old dissertation from the school's website. Keywords like "Cost Driver in Dual Channel Distribution" have been used. Mostly international journals were used as secondary data, white papers, reports, official papers.

5.1 Quantitative Data Analysis

Two companies based in the Norway were interviewed to identify the strongest predictors of total cost of running dual channel businesses. The company 1 works with the textile garment's apparels business and the company 2 runs business of sports product. Both the companies were requested to provide information about warehouse space and throughput during 2017 and 2018 seasons and the equipment, labor, storage, ordering and maintenance costs. I thus obtained four (2 companies x 2 years) data points for each of these parameters. I am thankful to the companies for provision of these data.

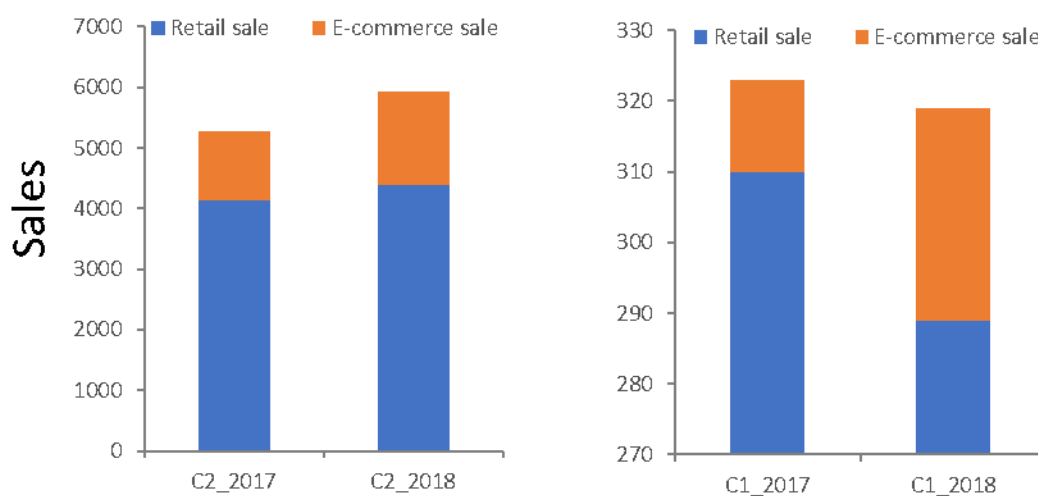The figure below shows that E-sales increased for both the companies during 2018 by comparison to 2017.

Figure 9: Retail and E-commerce sales of company 1 and company 2 during 2017 and 2018. (by own)

Scatterplots for the relationship between various parameters and total costs are shown in Figure below. R-squared (R^2) represents how close are the data to the fitted regression line and explains the proportion of variance for dependent variable (total costs) explained by various independent variables (Space, throughput and equipment, labor, storage, ordering and maintenance costs).

Next, I investigated the relationships between various cost related parameters with total costs. Among the predictors related to cost parameters labor, storage, and maintenance costs are significantly correlated with total costs. From given data we observed that the R^2 vales is very high in our calculation. So, we can say that the storage cost is high because the holding cost is directly linked with the capital invested, to reduce the total inventory cost companies have to minimize the storage cost. Storage cost can be minimized by using different inventory policies like the just in time JIT approach or the also by reducing the order size of the product by giving order in small batches and frequent delivery from supplier. It is also assumed that product vale is high, or some part of the inventory cost is high. In Norway the weather and the season also effect on the storage of the products. The labor line also showing strong correlation towards the inventory cost although due to advancement in technologies now mostly warehouse activities are performed automatically by robotics but even though the labor charges are very high in Norway, the minimum wages rate is very high here, but, possible in other country where the wages rate are not high have strong effects on total cost of inventory but also chances to have lest automated warehouse. In our observation the maintenance cost also have significant value, in our observation the maintenance cost is very wide it cover the all charges inhouse tools and machinery and also the transport and logistics used to deliver the goods to store and the companies operated office vehicles and also the head office maintenance cost also included in it.

Although the land cost is one of the major cost drivers to inventory because of the lease and rent charges paid on monthly basis or even the own warehouse. The warehouse cost is comparatively less significant. While these analyses strongly support the idea that storage and labor costs contribute substantially to the total costs of running a dual channel distribution, a major limitation of this analysis is that we have not sufficient data due to COVID 19 and companies also strict policies to share their confidential data especially for study analysis and number of observations are limited. A more comprehensive analysis

across different countries and companies is required to test the conclusions of my study.
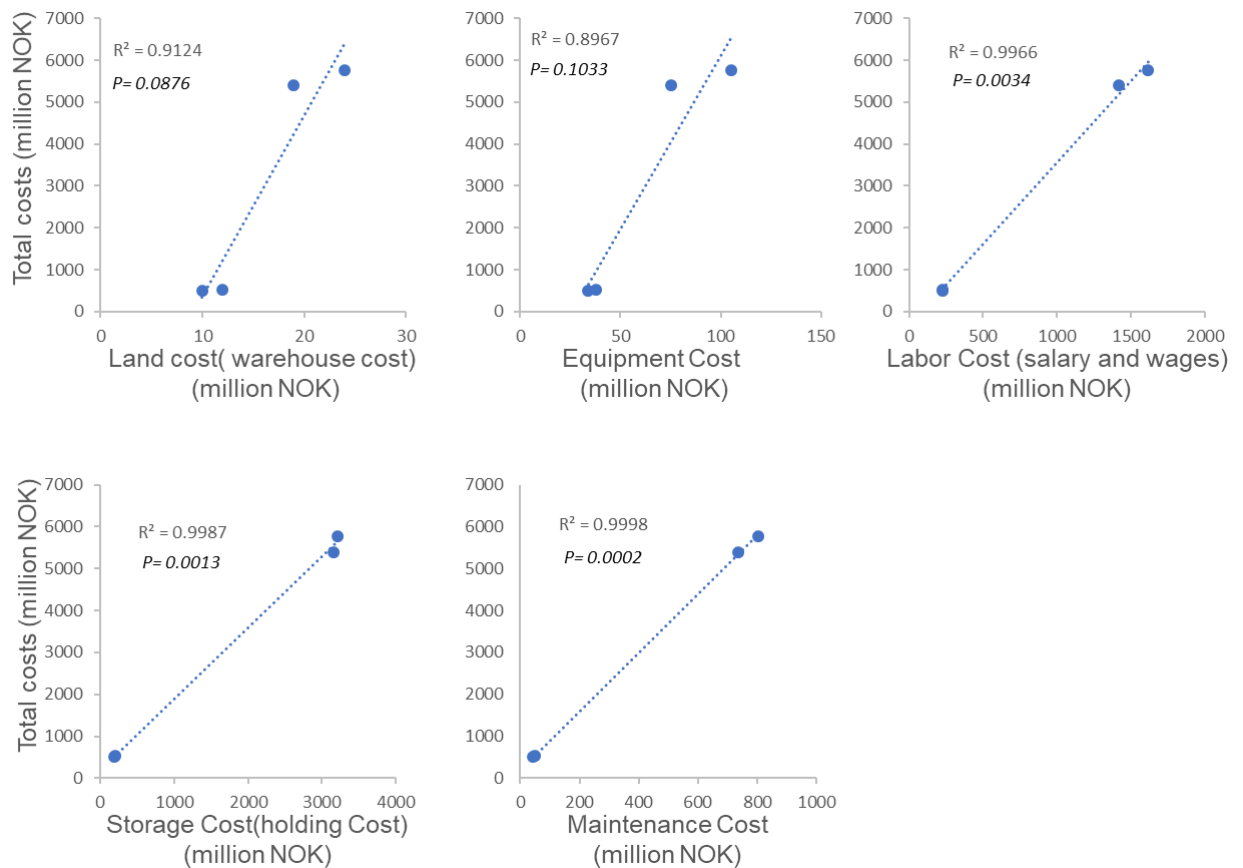

Figure 10:Scatterplots for relationship between and total costs with cost related parameters mentioned.

R^2 represents the determination coefficient and P values of Pearson's correlation coefficient are mentioned.

There are numbers of factors contribute to the inventory cost in dual distribution; like demand fluctuations, wrong forecasting, seasonality, price protection cost (heavy buying due low pricing, sales decline due to prices), excessive product return cost (reverse logistics cost as well), holding cost of inventory, which covers both the capital cost of money tied up in inventory and the physical costs of having inventory (warehouse space costs, storage taxes, insurance, rework, breakage, spoilage, overhead charges any many other but the main are land cost, labor , maintenance and equipment cost are the main cost drivers in dual channel distributions.

6   Research Summary

With change of technology, customers' needs change and to meet the customer need companies are changing their businesses from conventional to modern and updated versions.

The retail industry also advanced and now need to introduce the new and multi channels to increase the customer base. As demand increase companies need more inventory and the cost of inventory is also very important especially in dual channel distribution.

There is very limited literature work to identify the main cost drivers of inventory especially when one company operate both retail and e-tail and offering the multi-channel distribution. There is a big challenge for such companies and the warehouse managers to minimize the overall cost doing business and efficient use of resources. In e-tail business the cost of inventory is very important and playing a vital role in financial report as the investment in inventory is directly affected to capital of company. As holding inventory directly hit to your capital and use more labor space and overhead charges to handle it. The labor cost is very high especially in advanced country. Some of the more advanced e-tail's goals include the increase in sales and reduction of markdowns from matching excess store inventory in a slow geography to strong demand from online shoppers. Also, the agility enabled by integrated channels allows retailers to flexibly deploy labor resources to support both brick and mortar and e-commerce operations as demand changes. The e-tail orders and fulfillment process known as "click-and-collect" is especially prevalent in European grocery retail. This process, involving the pairing of online ordering with customer pick-up, is commonly facilitated through localized warehouses with drive-up kiosks. These warehouses or "drives" are sometimes standalone operations and at other times are co-located with standard retail locations.

Warehouses that have historically focused on pushing inventory to replenish stores are being expanded with new zones to support e-commerce. The integration of these channels is being done in an attempt to streamline costs, develop a holistic and extended view of inventory, and provide a consistent view to the customer. Consequently, the combined operations contain more complex warehouse processes; demand more complex slotting optimization; and require a wider range of material handling and labor requirements. More specifically, multi-channel warehouses require new logic to manage e-commerce waves, put wall processes, and shipment documentation. E-commerce fulfillment also has different volume patterns than traditional fulfillment due to being direct to consumer.

A large percentage of these multi-channel distribution channels still function with functionally separate operations located under the same roof. But many are integrating the fulfillment operations of the traditionally distinct channels. For example, some of the more visionary objectives for fulfillment channel integration include the sharing of labor and inventory across traditional and e-commerce fulfillment operations within the distribution

channels , the inclusion of fulfillment costs in the fulfillment and order promising decision making processes, and the development of more efficient e-fulfillment from stores.

Finally, the speed of development has left a gap in literature where current literature analyzes e-commerce subproblems (Kembro, Norrman, and Eriksson 2018). There are only few researchers who done the research on challenges of company switching from single channel to dual channel e.g.,(Hübner, Holzapfel, and Kuhn 2015b, Mena et al. 2016, Kembro, Norrman, and Eriksson 2018). The new trends in the market and technological developments in retailing have had a substantial impact on warehouse operations. Our purpose of research were to find the cost driver which factor has the more impact on inventory cost and also to find which factor or factors is most important and have most impact on the inventory cost in warehouse when a warehouse is operating the dual distribution. This study was based on given data about the holding cost of inventory in stock for both retail and e-tail, salaries and wages of labor plus employee benefits expenses i-e the amount paid to the warehouse employee on ad hoc and permanent basis of the year 2019 and social security and pension funds etc. Machinery and equipment central warehouse charges, capital lease payment for central warehouse.

6.1   Managerial Implications

 The dual-channel model shift is being driven in large part by the growth of e-commerce, evolving customer demands, and retailers' efforts to develop more efficient operations. Fulfillment operations are central to multi-channel retail. Those companies that have not yet begun the integration of channels still have time to adapt to the changing environment. Dual-channel operations are likely to continue expanding, as smaller companies and late adoption regions adapt their operations. Meanwhile, those companies that have already operationalized dual-channel fulfillment now look to improve upon efficiency and flexibility. I therefore expect dual-channel commerce and fulfillment to expand and evolve for a number of years.

The academic contribution of this research paper is to highlight the factors that contribute to inventory cost in warehouse when one company have both retail and e-tail activities. Even though several companies in the retail industry sell their goods online and offline, this research is delimited to Norway. For the best result of research if we include the cross-border companies gave more data and more knowledge for this research and better result to compare

the differet warehouse operation approaches. The findings may give an indicator of how a multi-channel warehouse have major cost drivers and how they have contribution in total cost. Also, it can give awareness to the inventory model, labor orientation and the space agreement for long run when a company's objective to offer both retail and e-tail DC. For retailers that are planning to expand to multiple channels, this may be new knowledge, and the retailers can take the findings into the evaluation. To improve current performance, retailers can get an idea for areas of improvement and where cost can be reduced in a warehouse.

6.2 Limitations Of The Study

Almost every research and study have some limitation, this one also has some limitations. For our research purpose both companies have different nature of business, different customer market, different customer base, number of stores, the stores size also different, product line and product range is also different in terms of sale, revenue and storage as well. Further both companies have warehouse operations and procedure of activities like packing, receiving and shipping of orders. So therefor it some cost factors cannot be analyzed across the warehouse for example in C1 there are more employee work in warehouse in C2 the warehouse use robotics for some activities. Therefore, the researcher does not have a full overview of cost factors in the warehouses. Furthermore, both companies did not provide the complete access to the warehouse cost and sale and other data due to secrecy of companies of data into market. On top of that due to COVID 19 which was at high in Mid of march we were unable to get access to warehouse for observation and to get data. For interview purpose warehouse managers also did not give proper reply of all our questions, However, we do our best to get more accurate data and to arrange for our analysis purpose and to extract the best of information from data. There was gap in data like both companies do not have separate data for peak and off peak seasons sales and cost, as both are working here in Norway and the Norwegian weather effect the seasonal sales, purchasing and holding inventory and transport and logistics operational cost. Both of the companies operating as group so there was also difficulty to get accurate data for our purpose.

6.3   Suggestions For Further Research

There is always a room for improvement in every research because there is some limitation in search, sometime due to lack of information, wrong data, unable to get access to data or time constraint. This research also opens up a lot of possibilities for further research. This study may serve as a basis to better understand current issues and challenges for retailers with multiple channels. Also, areas of improvement and further development can be identified. For example, how automation and developing IT-systems can change the way the warehouse employees work, and thereby, create opportunities for retailers. It can be important for retailers to be aware of how expanding online affects the warehouse operations and different cost factors can be control in warehouse. This awareness can contribute to more effective and efficient inventory planning, reorder point, using new concept of Just in time inventory, SKU and a lot of others opportunities can be discuss and investigate like how automated warehouse can reduce the labor cost, how latest technology can improve the output and minimize the equipment cost and maintenance cost. Also, a detailed cost analysis can be conducted for all warehouse processes. This study is limited to only warehouse operations and to find only cost factors in overall but further study on each factor. For further studies, an investigation of other parts of the supply chain can be analyzed, such as the manufacturer, transportation cost in e-tail, more the one warehouse. Although this study has a limitation regarding demographics, future research could validate the results in this study by incorporating more warehouses.

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