UNIVERSITY OF KWAZULU-NATAL

THE EFFECT OF OMNI-DISTRIBUTION SYSTEMS IN MANAGING DEMAND ORDER FULFILMENT FREQUENCIES: AN APPAREL RETAILER

By

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DECLARATION

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ABSTRACT

There is no gainsaying that the world of business is characterised by its own set of commercial dynamics. It is within this milieu that the study explores the emerging strategies that characterise the world of commerce with its myriad challenges. In the prevailing commercial environment it is observed that retailers are adopting the omni-channel approach as customers demand a more seamless shopping experience. To remain competitive, distribution networks are challenged to fulfil volatile customer demand from the omni-channel. South African retailers have taken to digital platforms despite barriers to entry in respect of the high cost of broad band and logistics challenges The research objectives of this study aim firstly, to determine the effects of omni-channel retail adoption by retail apparel companies in managing the transformation of the supply chain retail distribution systems; secondly, to examine the extent of relative change in demand to which the distribution systems enhance frequencies of order fulfilment, lead time and cycle time and fill rate; thirdly, to ascertain how the demand-driven omni-distribution systems influence the order fulfilment frequencies in a designated supply chain network; and finally, to establish the perceived contribution of integrated information systems towards information sharing and visibility within the virtual omni-distribution network.

Omni-channel retailing is a contemporary topic with very little literature available especially in a South African context. The study employs deductive reasoning with the use of an exploratory case study which adopts a mixed-method approach. The exploratory nature of the study involves the exploration of new phenomena to understand the relationship between variables using interviews and a survey to collect data. Based on a population of 333 managers from 161 stores, 175 assistant store managers, store managers and area managers were surveyed and 13 senior managers and directors from Retailer X and the third party logistics (3PL) were interviewed. The univariate and bivariate methods were used for quantitative analysis while content analysis was used in the qualitative approach.

The study reveals that the dispersed landscape and spectrum of cost consciousness to convenience focused customers warrants a customized distribution approach for South African retailers. Using the principles of leagility under the push-pull theory, cost and lead time has to be managed to achieve perfect order fulfilment.

Key words: Omni-distribution, push-pull theory, demand-driven model, just-in-time distribution, leagility and order fulfilment.

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 Introduction

The advent of digital technology has given rise to connected consumers, who are also known as Generation C. This generation is more informed, extremely demanding, vigorously social and always connected (Turner, 2014:4). These consumers' ages range from twenty to forty years. However, customers over the age of fifty five with a high disposable income are also reported to increase digital channel adoption (Turner, 2014:4). According to Deloitte Touche (2014:9) connected consumers are highly interactive with digital devices and seek out information and products. To keep up with the expectations of new age customers, there has been a shift from the brick and mortar to multi-channel retailing. However, a demand for a more seamless and flexible shopping experience has given rise to omni-channel retailing. Omni-channel retailing tracks customers across all channels and conveys a consistent brand message (Tetteh and Xu, 2014:3). Consumers have identified the benefits such as additional choice and quick delivery from buying across channels instead of purchasing from the traditional brick and mortar. Retailers are expected to fulfil orders from and accept return to distribution centres, stores and vendors whilst having complete visibility and flexibility to manage inventory across all channels (Fortna, 2015:2). In the European fashion market, particularly UK, there is a strong online presence with the majority of sales being made through electronic commerce (e-commerce) and mobile commerce (m-commerce) channels (Deloitte Touche, 2014:4). Retailer X's entry into online retailing, the distribution network and order fulfilment strategy will be examined in this study from a South African standpoint.

John Bovill, group IT director for Aurora Fashions, UK Oasis Group, said: "The fashion business was a push model; we used to push out to the market. But consumerization is turning that push model on its head. What we have now is a pull model, where customers are shaping their own buying experiences."

1.2 Background of the study

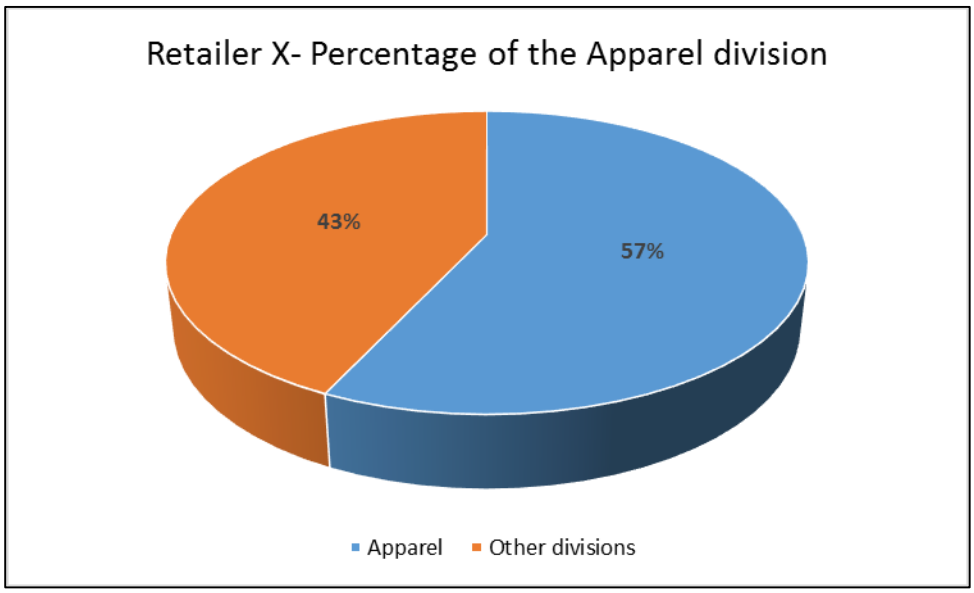
A study conducted by Deloitte Touche (2014:19) found that the European fashion industry has rapidly adopted omni-channel retailing and has experienced an increase in sales. Furthermore, the BRIC countries are expected to experience a growth in e-commerce of over 200% by 2019 (Turner, 2014:4). Hauss (2014:3) supports the findings of Deloitte Touche and Berg that there is a growth of multiple channel usage internationally. The adoption of cross channel buying abroad therefore appears to be gaining momentum with the brick and mortar playing a significant role.

In South Africa, there are barriers to progression in the retail electronic-commerce realm owing to the high cost of broad band Internet (PWC, 2012:21). However, the number of online users have increased by 25% due to an increase in mobile commerce (PWC, 2012:21). Edgars, Foschini and Mr Price, some of the largest retail chains in South Africa, are leading retail growth into neighbouring countries (Tempest, 2015: para. 4). In 2008, Amazon.com blacklisted the South African postal service due to concerns of theft (PWC, 2012:21). In addition, deteriorating postal service such as strikes and delivery delays, rising courier costs and delivery to homes is evident that the progression of door to door delivery is constrained. It is evident that omni-channel retailing is rapidly being adopted in the UK, with growth steadily on the rise in Brazil, Russia, India and China. In an attempt to keep up with demand and remain competitive, South African retailers such as Retailer X have taken to digital platforms. However, there are barriers to entry in respect of the rising delivery cost. Omni-distribution retailing creates a need for integrated systems and flexible distribution networks to ensure orders are fulfilled in full and on time. Retailer X will be used as a case study to establish how distribution systems are fulfilling omni-channel demand.

1.2.1 Retailer X

Their business model is to offer fashionable merchandise at "everyday low prices". The Apparel divisions comprises 57% of total Group turnover as depicted in figure 1.1 (Retailer X, 2015).

Figure 1.1: Apparel's % of Total Group Turnover



Source: Retailer X. (2015)

Retailer X's vision is to become a top performing international retailer. Retailer X's consumers are fashion and value conscious. They are primarily from LSMs 6-10 and ages 0-50 who are described as having a youthful attitude (Retailer X, 2015: para. 4). Retailer X's goal is to achieve fast fashion and quick response with high stock turnover globally (Retailer X, 2015: para. 4). As part of their omni-channel approach, they launched their e-commerce platform in July 2012. This study aims to examine how Retailer X is overcoming omni-distribution challenges from a South African stand point to fulfil demand and remain competitive on the global scale.

1.3 Research problem

Retailers are adopting the omni-channel approach as customers demand a more seamless shopping experience. To remain competitive, distribution networks are challenged to fulfil volatile customer demand from the omni-channel. Omni-channel retailing has facilitated the growth of international retailers, particularly in the UK. Furthermore, quick deliveries are made within short lead times while mitigating shortages and the bullwhip effect through electronic information sharing and visibility.

Nevertheless, South Africa is faced with logistics and broadband challenges which need to be overcome to ensure orders are fulfilled in full and on time through the use of omni-distribution systems. There is a need to establish how these retail companies are managing their distribution network to fulfil demand. This study aims to establish from a demand driven model, whether consumer demand orders need to be frequently fulfilled on time and in full with the use of flexible omni-distribution networks with a real time, highly granular view of inventory across channels from a South African context.

1.4 Research questions

1.4.1 What effect has the adoption of omni-channel retailing had on managing the transformation of the supply chain retail distribution system?

1.4.2 How does the relative change in demand influence distribution systems in enhancing the order fulfilment lead time, cycle time and fill rate?

1.4.3 How does the demand-driven omni-distribution system influence the order fulfilment frequencies in a designated supply chain network?

1.4.4 What is the perceived contribution of integrated information systems towards information sharing and visibility within the virtual omni-distribution network?

1.5 Research objectives

1.5.1.1 To determine the effects of omni-channel retail adoption by retail apparel companies in managing the transformation of the supply chain retail distribution systems.

1.5.1.2 To examine the extent of relative change in demand to which the distribution systems enhance frequencies of order fulfilment, lead time and cycle time and fill rate.

1.5.1.3 To ascertain how the demand-driven omni-distribution systems influence the order fulfilment frequencies in a designated supply chain network.

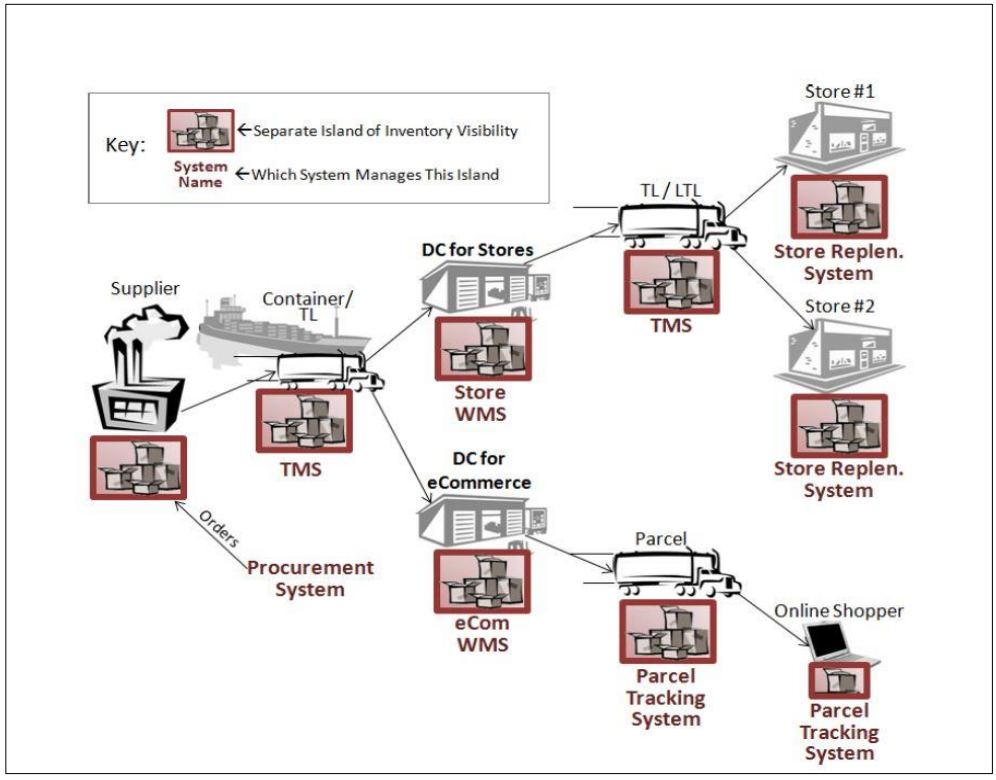
1.5.1.4 To establish the perceived contribution of integrated information systems towards information sharing and visibility within the virtual omni-distribution network.

1.6.1 Traditional distribution to Omni-distribution

Traditionally, customers purchased from brick and mortar and were limited in their product choice. According to Tetteh and Xu (2014:1) the brick and mortar is a retail channel in which customer demand is met with on hand inventory. The arrival and growth of online shopping resulted in customers shopping at Pure Play (digital retailer) sites like Amazon, E-bay, Spree and more locally, Zando and Superbalist.

This resulted in brick and mortar retailers having to extend their business to include digital platforms to remain competitive. Retailers therefore adopted the multi-channel retailing approach which entailed them selling merchandise or services through many channels which existed independent of each other (Tetteh and Xu, 2014:2). By using multiple channels, the benefits of each channel is utilized to attract and satisfy more customers (Levy and Weitz, 2007:83). However, there is minimal visibility of inventory across channels as illustrated in figure 1.2. The resultant effect is excess holding cost, buffer stock, products becoming obsolete, lost sales and lost customers.

Figure 1.2: Inventory systems and inventory stores working in siloes

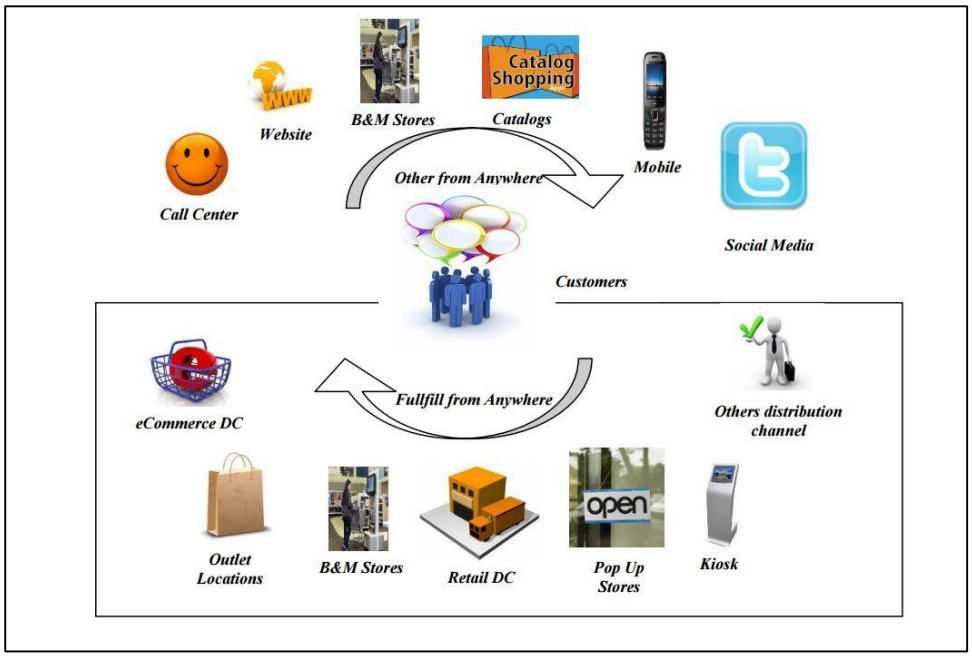


Source: McBeathe, Omni Retailing Markets Association (IORMA). (2014) *Africa…In an Omni World*. [Online]. Available: http://www.iorma.com/reports/uk-retail-market-opportunity-report-may-2014 [1 May 2014]

Tetteh and Xu (2014:3) cite Rosenblum and Kilcourse (2013) that digital and physical channels need to become integrated to provide a seamless customer experience by communicating the same brand experience across all channels coupled with the ability to fulfil from anywhere. This is achieved with omni-distribution, as illustrated in figure 1.3.

Retailers are expected to fulfil orders from and accept return to distribution centres, stores and vendors whilst having complete visibility and flexibility to manage inventory across all channels (Fortna, 2015:2).

Figure 1.3: Omni-channel order placement and fulfilment



Source: Tetteh and Xu (2014:3) 'Supply chain distribution networks- single, dual and omni-channel'. *Interdisciplinary Journal of Research in Business*, 3(9): 1-11. [Online]. Available: http://idjrb.com/articlepdf/2014_issue9/4.pdf [5 March 2014]

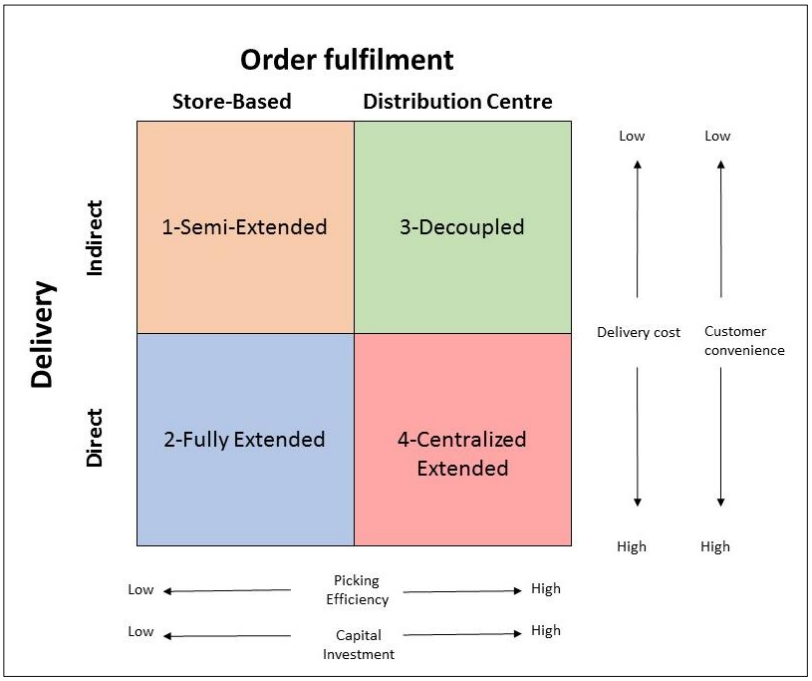
Customers' orders need to therefore be fulfilled on time and in full with the use of flexible distribution network with a real-time, highly granular view of inventory across channels. Omni-distribution/logistics network

1.6.2 Omni-distribution/logistics network

Unpredictable demand and time sensitive customers create the need for short lead times hence agile supply chains. Riasanen (2013:18) is of the view that fast fashion retailing is demand driven and requires agility and flexibility as key differentiators in the supply chain. According to Christopher (2005:122) agility comprises market sensitivity, virtual integration, process integration and networking. The author further states that agile supply chains require quick response strategy with shorter cycle times. This can be achieved by reducing the length of the pipeline or speeding up the flow through the pipeline by removing bottlenecks, excessive inventory, utilizing sequential processing and maintaining visibility (Christopher, 2005:133).

Boyer, Frolich and Hult (2005:19) make reference to 'last mile supply chain deliveries' which is based on two essential decisions associated with extending the supply chain, location of order fulfilment and delivery as illustrated in the Order Fulfilment/ Product Delivery Matrix in figure 1.4.

Figure 1.4: Order Fulfilment/ Delivery Matrix



Source: Boyer, K.K, Frolich, M.T and Hult, G.T.M. (2005) Extending the supply chain. 1st edition. New York: Amcom Books

1.6.2.1 Order Fulfilment/ Delivery Matrix

Firstly, order fulfilment can occur either from a store or distribution centre. Secondly, delivery of the order can be made directly to the customer's home. Alternatively, it can be picked up in-store or from the distribution centre. The following strategies can be used:

- 1- Semi-Extended
- 2- Fully Extended
- 3- Decoupled
- 4- Centrally Extended

Firstly, Semi-Extended strategy refers to orders that are fulfilled from the store and picked up at the store by the customer. This strategy offers customers low delivery cost. However, it is less convenient for the customer, more inefficient and challenging with regards to inventory tracking in-store compared to the distribution centre depending on the inventory system being used. Best Buy and Walgreens use this strategy (Boyer *et al.,* 2005:20). Secondly, Fully Extended strategy makes reference to order fulfilment that occurs from the store and delivery is made directly to the customer.

Picking efficiency and capital investment maybe low since fulfilment is from store, however, delivery cost and customer convenience will be high. Tesco and Sainsbury use this strategy (Boyer *et al.,* 2005:19). Thirdly, Decoupled strategy refers to order fulfilment which occurs at the distribution centre and is picked up from the distribution by the customer. This strategy is used by companies that want to achieve low delivery cost and high picking efficiency, however, it also incurs low customer convenience and high capital investment. Dell uses this strategy (Boyer *et al.,* 2005:19). Fourthly, Centralized Extended strategy refers to order fulfilment from the distribution centre and deliveries being made directly to the customer. Companies using this strategy are likely to achieve high delivery cost whilst providing high level of customer convenience as well as high picking efficiency and high capital investment. OfficeMax uses this strategy (Boyer *et al.,* 2005:19). Strategic planning of last mile supply chain deliveries are therefore crucial to order fulfilment. Sonier (2014:5) also believes that online fulfilment from stores (door to store) is more beneficial than using a separate E-commerce DC. The distribution network has to therefore be adapted or even redesigned to achieve cross channel flexibility to fulfil demand. It therefore needs to be established how Retailer X has adapted or even redesigned its distribution network to accommodate for cross channel buying to fulfil the needs of customers in full and on time.

1.6.3 Order fulfilment

Ballou (2004:92) cites Heskett (1994) "logistics customer service is the speed and dependability which items ordered by customers can be made available". Ballou (2004:98) also states that customer service has been referred as a fulfilment process. The author states that the following are considered the most important customer service elements of order fulfilment:

- On time delivery
- Order fill rate (Orders in full)
- Product condition
- Accurate documentation

Accurate documentation and product condition are necessary requirements of order fulfilment with the underpinning fulfilment measures of the study being, order fulfilment through on time delivery and order fill rate. According to Kilcourse and Rowen (2014:10), the top five methods of shipment which creates the most value to customers are same day shipment, followed by drop shipment from vendor direct to customer, drop shipment from vendor direct to store, online visibility of in-store inventory and in-store inventory pick up. Forrester (2014:5) findings correlate to Kilcourse and Rowen (2014:10) with the exception that customers also expected a clear indication of when their order will arrive.

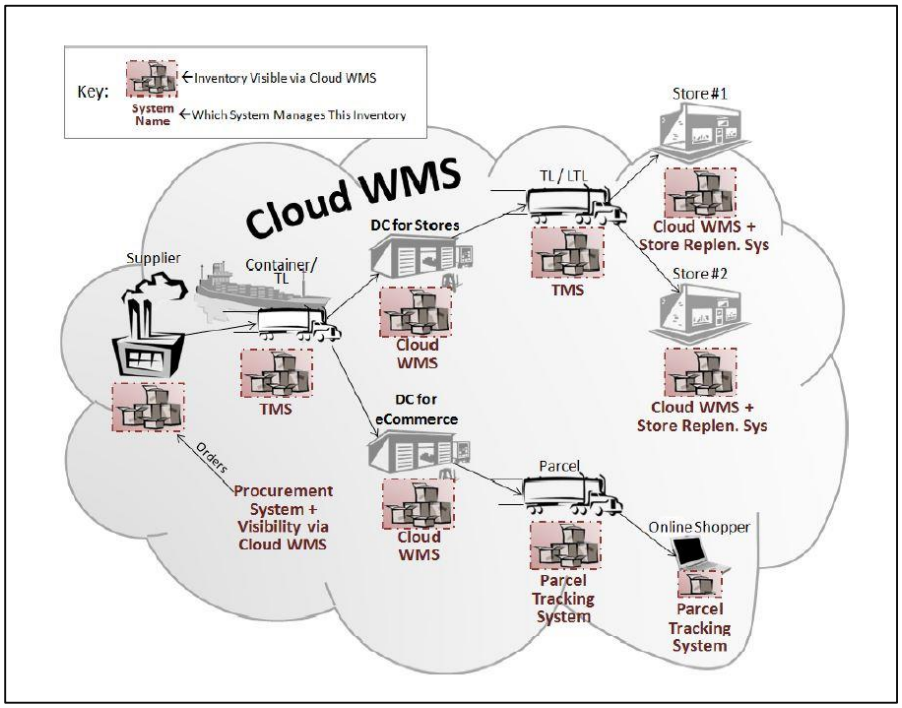
The authors also identified that the top five fulfilment methods being utilized by retailers in order of most frequently adopted fulfilment method to least. Firstly, the reservation of products for in-store purchase. Secondly, shipment direct to customer of online inventory. Thirdly, in-store pick-up followed by in-store visibility of inventory and same day delivery.

Findings of a study conducted by Hauss (2014:13) suggest that buying online and pick up in-store, followed by the option to buy in-store and have purchases delivered are preferred by customers. Although the sequence of order fulfilment methods differ, there is commonality amongst the methods being used among retailers. Hauss' findings therefore closely supports the findings of Kilcourse and Rowen (2014:11) as well as Forrester (2014:5). However, there is also a gap between the order fulfilment methods that customers value and the methods being provided by retailers. According to Conrad, Hagen and Kauffeld (2012:15) and supported by Kilcourse and Rowen (2014:16), shorter delivery times will become increasingly necessary led by Amazon's two day and overnight shipping.

1.6.4 System advancements and visibility

Cloud based technology and information systems are being used to create a unified database as illustrated in figure 1.5 (Mcbeath, 2012:5 and supported by The Park Avery Group (2015:4). An integrated order management system provides end-to-end control and a unified view of the entire process, dynamically linking network inventory with demand from supplier to consumer, providing an accurate count of every stock keeping units (SKU) available to promise (ATP) number and the date the product needs to be delivered to the customer. ATP is a business function that calculates whether orders can be fulfilled based on stock on hand and stock in the pipeline.

Figure 1.5: Cloud based visibility across inventory systems



Source: McBeathe, Omni Retailing Markets Association (IORMA). (2014) *Africa…In an Omni World*. [Online]. Available: http://www.iorma.com/reports/uk-retail-market-opportunity-report-may-2014 [1 May 2014]

Cloud based technology provides visibility of detailed data end to-end, in real-time, from various sources across the chain via automated data collection such as radio frequency identification (RFID), barcode scanning, and point of sale (POS) devices. The architecture of the cloud facilitates integration with other systems to collect and centralize inventory-related activities, transactions and data to provide a relative advantage over siloed systems. It is evident that quick response order fulfilment in agile distribution networks are enhanced by system wide visibility. In line with these views it is necessary to understand how Retailer X is fulfilling customers' orders with its omni-distribution network as outlined under the objectives.

1.7 Theoretical Framework

1.7.1 Just in Time Levelled Distribution Scheduling

The basis of the Just-in-time system is to produce and deliver finished goods just in time to be sold (Schonberger, 1982:16). Conventional scheduling required large batches of parts to be produced on a daily basis which resulted in significant work in progress inventory being carried forward. Levelled scheduling aims to achieve control and visibility of daily production by producing and transferring smaller batches of inventory between stages to reduce work in progress and increase the quantity of finished products (Chamber *et al.,* 2007:482). Ballou (2004:442) states that concepts from Just in time scheduling can be applied to the physical distribution channel to provide a competitive advantage which is supported by Chamber *et al.,* (2007:482). The authors state that traditionally, large truck loads were despatched to stores supplying inventory for a week. Alternatively, with Just-in-time levelled distribution scheduling, smaller quantities are despatched to stores more frequently to reduce inventory holding costs and respond to changes in demand by adjusting the quantity stock keeping units (SKUs).

1.7.2 The Push- Pull theory

In a push theory, the manufacturer manufactures goods based on forecast demand and pushes the stock downstream to be available at various locations. The various uncertainties associated with forecasts make it imperative that safety stocks be kept in anticipation of demand (Christopher, 2005:123). Pull theory is based on real demand where production is done in accordance with demand (Christopher, 2005:123). The push-pull boundary allows for the organization to take advantage of the best of both these strategies (Simchi-Levi, Kaminsky and Simchi-Levi, 2008:190).

According to Christopher (2005:120), supply chains are decoupled when shorter lead times are required due to unpredictable demand. Christoper (2005:123) further states that demand pull theory underpins the Just-in-time distribution system. The basis of this theory is that distribution systems are synchronized in response to the requirements of the operations or customer. Christoper (2005:123) therefore supports the view of Schonberger (1982:41). As part of the communication mechanism of a decoupled supply chain, a push-pull theory will be utilized with the pull theory underpinning the JIT distribution system. The pull based supply chain theory has propensity to decrease the lead time through the ability to better anticipate incoming orders and frequently fulfil consumer orders (Simchi-Levi *et al.*, 2008:189).

The pull theory is well suited with the study to explore the effects of demand-driven distribution systems on order fulfilment frequencies in omni-channel apparel retail companies. According to Simchi-Levi *et al.,* (2008:189), the pull-based supply chain theory mitigates the bullwhip effect through demand driven distribution system. By the same token, frequent order fulfilment is visibly co-ordinated with true consumer demand rather than forecasted demand. Using this principle and on the premise of this theory, the omni-distribution system is aimed to virtually pull supply chain activities from demand driven order fulfilment to reduce system inventory whilst enhancing the ability to manage supply chain resources and information sharing.

1.8 Significance/importance/contribution of the study

This is the first study, to the researcher's knowledge, to examine how Retailer X has adapted its distribution network and fulfilment of volatile customer orders having adopted omni-channel retailing. The study will examine the company from a South African context in relation to omni-distribution systems in the international retail market. Findings will identify gaps and possibly identify solutions to close these gaps from a South African Apparel Retail standpoint. Knowledge gained will assist in understanding what needs to be done by the company and other similar South African Retailers to fulfil demand more competitively.

1.9 Justification of the study

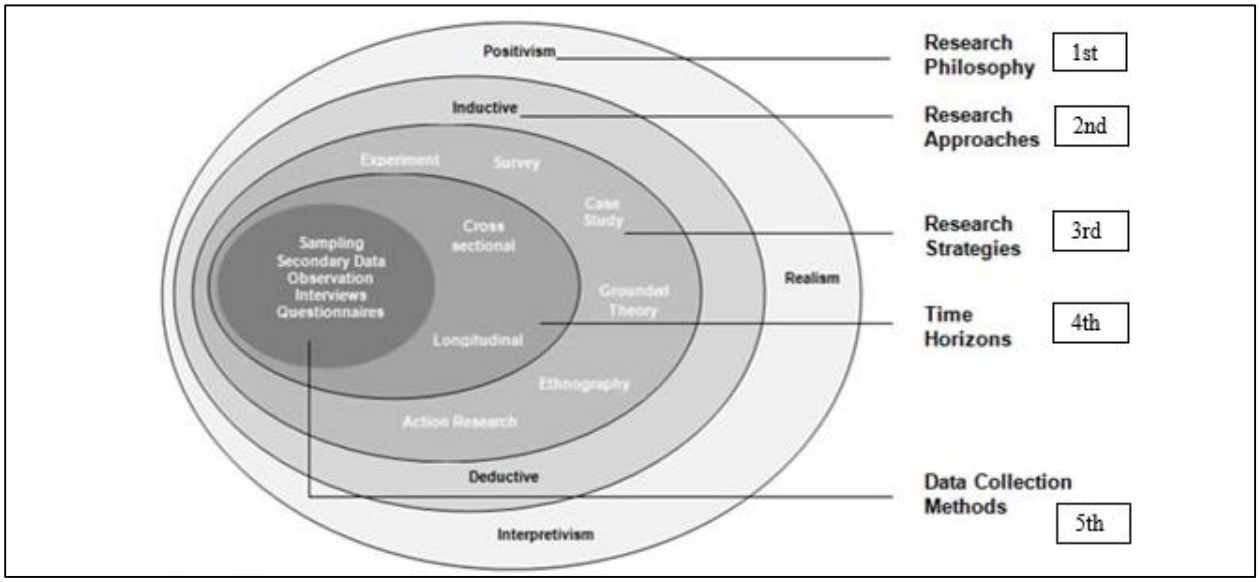
There is an ever growing customer expectation. As retailing becomes more global, competition gets tougher. Retailer X is one of the largest retail chains in South Africa leading retail growth (Tempest, 2015: para. 4). There are no studies on Retailer X's adaption of its distribution network and order fulfilment strategy with omni-channel retailing being adopted. There are limited studies on the adoption of omni-channel retailing and omni-distribution by South African Retailers in relation to systems abroad. There is therefore a gap in knowledge. Having made an entry into online retailing by launching their e-commerce platform in 2012 and as leader in South African retail heading towards a global scale, it seems fitting to investigate how Retailer X has adopted omni-channel retailing to fulfil demand. Furthermore, it is necessary to understand how Retailer X has adapted its distribution network and is fulfilling customer orders in relation to omni-distribution systems abroad to remain competitive on a global scale.

1.10 Research methodology

1.10.1 The research onion

Blackmon and Maylor (2005:154) classify research in the form of nine levels of a pyramid with research approach at the top of the pyramid, followed by research philosophy, research perspective, research methodology, research design, research method, research tools and techniques, data and analysis. Lewis, Saunders and Thornhill (2009:138) have a more simplified classification of research, known as the research onion. It classifies research into six stages as illustrated in figure 1.6.

Figure 1.6: The research onion



Source: Lewis, P, Saunders, M. and Thornhill, A. (2009) *Research methods for business students*. 5th edn. England: Pearson Education Limited

Research philosophy comprises the first layer which is made up of positivism, realism, interpretivism and pragmatism (Lewis *et al.,* 2009:119). Research philosophy describes a theory of research and clarifies assumptions that underlie the research approach (Blackmon and Maylor (2005:155). Positivism is an epistemological position which requires an observable social reality be worked on and is thus an objectivist ontology (Lewis *et al.,* 2009:598). Realism is an epistemological position in which objects exist independently of our knowledge and their existence (Lewis *et al.,* 2009:599). It is an objectivist ontology like positivism however is value laden unlike positivism in which research is conducted value-free. Realism comprises of direct realism which states that our senses portray the world accurately whilst critical realism states that in addition to direct realism, additional mental processing of these senses are required (Lewis *et al.,* 2009:114).

Interpretivism is concerned about conducting research amongst people and establish the roles of people as social actors and is therefore a subjectivist ontology and is value bound (Lewis *et al.*, 2009:114) and Blackmon and Maylor (2005:157). Pragmatism comprises observable phenomena and subjective meanings as an acceptable source of knowledge which is integrated to interpret the data (Lewis *et al.*, 2009:119). This study aims to collect factual information through statistical calculations to arrive at findings and establish conclusions. Researcher value also forms part of the study since the topic was not appointed and is a topic of interest. Hence, positivism and interpretivism will not be used. Although value plays a role in the study, the researcher is not value laden. Objective and subjective points of view will be utilized. Hence, realism will not be used but pragmatism will be used instead.

The second level of the onion denotes the research approach to be used. Blackmon and Maylor (2005:154) define the research approach as a strategy for answering the research question which comprises deductive and inductive reasoning. Deductive reasoning is used for theory testing. It begins with an idea which is narrowed into a hypotheses which is tested to validate the original idea (Hair, Money, Page and Samoul, 2007:288). Inductive reasoning is used for theory building which essentially entails data being collected and analysed and theory being built from the findings (Schindler and Cooper, 2008:74). This study aims to establish from a demand driven model, whether consumer demand orders need to be frequently fulfilled on time and in full with the use of flexible omni-distribution networks with a real time, highly granular view of inventory across channels from a South African context. Hence deductive reasoning will be used rather than inductive reasoning to test if flexible omni-distribution networks with a real time, highly granular view of inventory across channels is needed to frequently fulfil orders on time and in full from a South African context.

The third level of the onion comprises the research strategy which entails the utilization of experiments, surveys, case study, grounded theory, ethnography and action research (Lewis *et al.*, 2009:114). Experiments occur in controlled environments in an attempt to manipulate variables to establish the effect of one variable on another in line with research objectives (Hair *et al.*, 2007:143). Surveys are conducted on samples to solicit information from particular individuals on the topic being researched (Kruger and Welman, 2002:91). Grounded theory involves the researcher constructing theories using qualitative data to understand phenomenon (Hair *et al.*, 2007: 289). Ethnography is the study of people and culture and concerned about finding meaning rather than measurement (Blackmon and Maylor, 2005:144). Action research requires researcher participation and observation in the field area to arrive at findings. Hair *et al.*, (2007:203) state that case studies are used to collect information about an activity in a firm or industry.

The purpose of conducting a case study is to establish a complete picture of the entire situation through the examination of a real life example (Hair *et al.,* 2007:203). Retailer X will be used as a case study and surveys will be conducted amongst experienced employees to gain a vast amount of information in line with the research questions. It is necessary to understand how Retailer X is fulfilling customer orders through its distribution network and how information technology is being adopted to fulfil orders and remain competitive globally.

The fourth level constitutes time horizon. Research studies have a time dimension which can either be cross sectional or longitudinal. Cross sectional studies are conducted once off at a point in time (Schindler and Cooper, 2008:144). Longitudinal studies are conducted repeatedly to track changes over a period of time (Schindler and Cooper, 2008:144). Cross sectional time horizon will be utilized to establish the current order fulfilment through omni-distribution in South Africa, Retailer X. According to Lewis *et al.,* (2009:155) case studies are well suited to cross sectional time horizons to acquire information at a point in time. Furthermore, due to time and budget constraints, a cross-sectional time horizon will be used. The fifth layer which is the centre on the onion, pertains to data collection methods. Using the research onion as guide, the study will be pragmatic, employing deductive reasoning with the use of a case study and survey. The study will hence adopt a mixed method strategy with a cross sectional time horizon subsequently leading to the research design.

1.10.2 Research design

Schindler and Cooper (2008:140) define a research design as an activity and time based plan which is founded on the research question and is a guide for selecting sources and types of information. The authors add that it is a frame work which outlines relationships amongst variables in studies and every research activity. Yin (2014:26) more simply defines a research design as a rationale that links the research questions to the data collected and conclusions drawn. Schindler and Cooper (2008:145) highlight that exploratory study, descriptive study or a causal study can be used. Exploratory studies are used to develop concepts more clearly, establish priorities, improve the research design and develop operational definitions (Schindler and Cooper, 2008:145). It is utilized when the area of investigation is new hence exploration is needed to gain information, discover new relationships, themes and ideas (Hair *et al.,* 2007:154). Descriptive studies are more formalized and are structured with a clearly defined hypothesis. It serves to describe phenomena associated with the population and discover associations amongst variables. Causal studies such as explanatory research aim to identify the effect a variable will have on another variable (Schindler and Cooper, 2008:157).

In addition, explanatory study may be adopted to ascertain relationship between variables and understand why phenomena occur (Ritter and Sue, 2012).Omni-channel retailing is a contemporary topic with very little literature available especially in a South African context. As supply chains become more global and competitive, distribution networks need to become more agile to fulfil orders faster. Although a descriptive study will be useful in characterizing associations amongst variables, more knowledge is needed in respect of what distribution systems are being utilized and what type distribution systems are needed to fulfil orders. Hence, an exploratory and explanatory study is therefore necessary.

1.10.3 Research Approaches/Paradigms

There are three research approaches such as qualitative, quantitative and mixed approaches. Qualitative data represents a description of concepts where data is collected by recording words and phrases. It is useful for discovering and provides a deeper understanding of information (Hair *et al.,* 2007:291). Quantitative data is usually represented by numbers and is useful for tracking trends (Hair *et al.,* 2007:304). A mixed method comprises a quantitative and qualitative approach. This study will take the form of a mixed method approach. Qualitative and quantitative data will be solicited and analysed to identify trends and gain insight on concepts and processes. Themes will be utilized to establish if key findings are complementary to each method.

1.10.4 Study site

The study site refers to the geographical area where the population exists and where the study will be conducted. The study sites is Durban. The Retailer X head office, Distribution centre and extended supply chain and third party logistics provider, City Logistics are situated in Durban which is suited to the qualitative component of the study. The Retailer in the case study and well integrated third party logistics provider constitute a single case study on underlying supply chain synchronisation and distribution.

1.10.5 Target population

Marsden and Wright (2010:85) define the target population as the group of elements that the researcher intends to study. The target population comprises Supervisors, Assistant Store Managers and Area Managers and Directors from the company as well as Directors from City Logistics. As illustrated in image one of the appendix, the target population for the quantitative part of the study will comprises 333 Managers from 161 stores. The target population for the qualitative part of the study will comprise 13 Directors and Senior Managers from Retailer X and City Logistics.

1.10.6 Sample

A sample is defined as a subset of the population (Marsden and Wright, 2010:86). Lewis *et al.*, (2009:212) state that a sample is used when it is impractical to survey the entire population, due to budget and time constraints and when results are needed quickly. The sample will comprise a subset of Managers and Directors from Retailer X and City Logistics.

1.10.7 Sampling method

A sample can be classified as a probability or non-probability. In the case of a probability sample, there is a known and equal chance of each case being selected. Probability sampling comprises sampling methods such as simple random sampling, systematic sampling, stratified sampling, cluster sampling and double sampling (Schindler and Cooper, 2008:395). In the case of non-probability sampling the chance of each case being selected is unknown since judgment is used. Non-probability sampling comprises sampling methods such as convenience sampling, purposive sampling, judgement sampling, quota sampling and snowball sampling.

Non-probability sampling is most useful in exploratory studies and is well suited for case studies (Lewis *et al.*, 2009:233). This study takes the form of an exploratory study from which new information needs to be acquired from people with a specific experience and skill set. Hence, non-probability sampling will be used. Purposive sampling comprises of judgement sampling and quota sampling. The former is selected when a set of research criterion needs to be conformed to, whilst the latter selects the subjects based on certain relevant characteristics and representativeness of the population (Schindler and Cooper, 2008:398). Specific elements of the population need to be selected which will best answer the research questions. The subjects of the sample need to have expertise regarding the distribution network and customer order fulfilment. Hence, the non-probability sample is purposive and a judgement sample will be used for the study.

1.10.8 Sampling and sample size

Using the mixed method approach, for the quantitative data of the mixed method approach, the research population comprises Store Managers and Area Managers. The managerial structure comprises Area Manager, Assistant Store Manager and store supervisor. As per the sample size decision table in Sekaran (2005:295), the sample will comprise 191 Managers in total based on a population of 333 Managers from 161 stores. Area Manager, Assistant Store Manager and Supervisor are being used since they manage stock from online sales and in-store purchases and are exposed to operational issues within the store.

They may identify opportunities for improvement. Furthermore, they engage with customers, hence they possibly gain a better understanding of customers' feelings about online buying and the frequency of online purchases. For the qualitative data, the research population comprises senior managers and directors from Retailer X and City Logistics. The sample will comprise 13 senior managers/directors who have more than 15 years experience in the industry. Senior Managers and Directors are being used in the study since they possess holistic and comprehensive knowledge of the business process and retail industry and can contribute significant insight. The Senior Managers/Directors selected, work at a Group level rather than department level. Hence, they will answer on behalf of the company as a whole. The sample is therefore an adequate representation of the Retailer X. All Retailer X stores in South Africa have the same operational processes. Hence, the sample is an adequate representation of the Retailer X.

1.10.9 Data collection instruments

Quantitative data can be acquired via surveys. There are three categories of surveys, self-completion, interviewer completed and observation (Hair *et al.,* 2007:304). Self-completed surveys comprise mail, e-mail and drop off/pick up surveys. Interviewer completed surveys are conducted in direct contact. Observations involve counting and numerical information. Self-completed surveys will be utilized to rapidly access a wide geographic reach. Surveys will be conducted with 191 Managers in total to identify a trend or common occurrence within the store in relation to stock movement, purchases and pick-ups by customers. According to Hair *et al.,* (2007:156), surveys are useful in cross sectional studies and is therefore well suited to the selected time horizon.

Qualitative data can be acquired via interviews. Interviews may be categorized as structured, semi-structured or in depth (Lewis *et al.,* 2009:320). Structured interviews utilize an interview guide which contain a set of standardized questions. In a semi-structured interview, a list of questions and themes may be covered based on the progress of the discussion (Lewis *et al.,* 2009:320). In-depth interviews are informal. For the purpose of this study semi-structured interviews will be conducted with the sample. Focus groups is an approach used to conduct semi-structured interviews as the moderator facilitates informal discussion with eight to twelve respondents guided by a list of topics (Hair *et al.,* 2007:196). Interviews will be conducted face to face with an interview group and with individual respondents if participants are not available to meet with the interview group. An interview schedule and audio recording device will be used for data collection. The use of interviews is common when case study strategy is adopted (Hair *et al.,* 2007:156). Furthermore, the use of interviews at a point is time satisfies the need for a cross sectional time horizon.

1.11 Data quality control

1.11.1 Reliability and Validity

The reliability and validity of data is crucial to the study. Reliability is a measure of consistency of the results over time based on the population in the study (Joppe, 2000) and is the extent to which the results are repeatable, stable and similar over time (Kirk and Miller, 1986), adapted by Golafshani (2003: 598). Reliability can be measured using test-retest as well as split-half reliability and Cronbach Alpha to measure internal reliability of quantitative data (Hair *et al.,* 2007: 242). Golafshani (2003: 598) argues that despite reliability commonly being used in quantitative research, it is established in a qualitative study by ascertaining the credibility, confirmability, consistency and transferability of the result. Sekaran (2010:384) adds that reliability of the qualitative instrument is assessed through the similarity of words and phrases using category reliability or inter-judge reliability Validity indicates if the instrument measures the concepts being studied (Marsden & Wright, 2010:372). Validity is measured by means of content validity, construct validity and criterion validity. Cronbach Alpha and the tenets of quality data will be used to support reliability of the instruments, whilst content validity will be used to support validity of the instruments.

1.12 Data analysis

Quantitative data can be analysed using descriptive and inferential statistics to facilitate univariate, bivariate and multivariate analysis. Descriptive statistics involves the comparison of values numerically through central tendency and dispersion (Lewis *et al.,* 2009:444). Inferential statistics allows for judgements to be made about the population based on findings about the sample (Hair *et al.,* 2007:330). Univariate analysis measures central tendency, dispersion and frequency distribution of one variable at a time (Blackmon and Maylor, 2005:313). Bivariate analysis uses two variables at a time using statistical measures of association such as correlation of co-efficient, linear regression analysis, t-tests and analysis of variance (ANOVA) to measure difference and Chi-squared test for nominal, ordinal, interval and ratio scales (Blackmon and Maylor, 2005:313).

Multivariate analysis looks at multiple variables simultaneously (Blackmon and Maylor, 2005:328). It has two main types of analysis, namely, dependence and interdependence methods. Dependence methods comprise multiple regression and multiple analysis of variance (MANOVA) (Blackmon and Maylor, 2005:336). Interdependence methods include factor analysis and cluster analysis. (Blackmon and Maylor, 2005:336). Differential and Inferential statistics will be used to establish findings about the sample hence population. The data will have to be captured, edited, coded and transformed, Data will be processed using SPSS programme to establish frequency and relationship between variables in the data set. Qualitative data will be analysed using thematic analysis which is a form of content analysis.

Thematic analysis allows the research to analyse a large quantity of textual data to identify words, patterns or themes (Sekaran, 2010:385). This form of analysis required text to be coded into categories. Thereafter, it is analysed using conceptual or relations analysis. It identifies the frequency of concepts and relational analysis examines relations between the concepts (Schindler and Cooper, 2008:423). Data will be processed manually on Excel using thematic analysis.

1.13 Conclusion

The onset of omni-channel retailing solicits a change in distribution systems in order to achieve order fulfilment across all channels whilst efficiently managing inventory in the distribution network. There is a need to understand how South African retailers have adapted their distribution network in response to omni-channel retailing to fulfil demand. The study aims to answer the research questions through the use of a case study with a mixed method approach. The acquisition of information using survey and interview will provide detailed insight on how order fulfilment frequencies are managed by distribution systems from a South African standpoint.

CHAPTER TWO

LITERATURE REVIEW

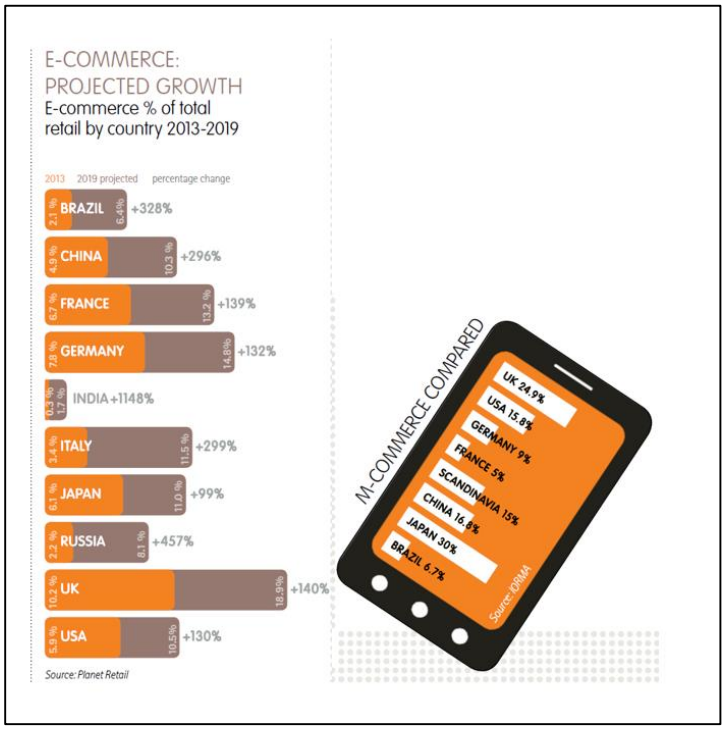
2.1 Introduction

To remain competitive, companies are required to keep abreast of the ever changing expectations of the omni-channel consumer. Ervasti, Isomursu and Mäkelä (2014:2) are of the view that empowered consumers have propensity to direct the omni-channel revolution. In response to changing customer preferences, technological investment is a key component in the omni-channel strategy (Solomon, 2013:8). The demand for a more seamless and flexible shopping experience has resulted in retailers having to realign operations within their supply chains to become more digitized and integrated (Ervasti *et al.*, 2014:2) and (Fortna, 2015:2). The emergence of omni-channel retailing requires retailers to have visibility of the supply chain with cross channel capabilities which can fulfil from anywhere via the omni-distribution system. Presumably, a combination of online and brick and mortar services necessitates the facilitation of cross channel fulfilment. Some of the common cross channel fulfilment methods comprise: click and collect at home or instore, order in store-deliver at home and order online-return to store (Cuthbertson and Piotrowicz, 2014:2). In the same token, Dwyer (2015:1) accentuates that the ability to deliver the full order to the right place, on time, in the perfect condition, with the correct documentation and invoice is essential in achieving perfect order fulfilment. Omni-distribution systems therefore require extensive flexibility and system integration to achieve perfect cross channel order fulfilment.

2.2 Background

Retailers in the United Kingdom (UK) have repositioned themselves to embrace omni-channel retailing to remain innovative and competitive (IORMA, 2014:2). A study conducted by Deloitte Touche (2014:19) found that the European fashion industry has rapidly adopted omni-channel retailing and has experienced an increase in sales. In addition to the 35% increase in customers' use of multiple channels in the UK, online exports from Europe is expected to achieve a 26% year on year growth (Deloitte Touche, 2014:24). As depicted in figure 2.1, UK is expected to lead electronic-commerce (e-commerce) retail with 140% growth by 2019 followed by the BRIC countries. Japan has been reported to lead mobile-commerce (m-commerce) with 30% growth followed by UK, China and USA with 25%, 15% and 16% respectively (IORMA, 2014:13).

Figure 2.1: E-commerce and m-commerce projected growth



Source: International Omni Retailing Markets Association (IORMA). (2014:13) *UK Retail Market Opportunity Report.* [Online]. Available: http://www.iorma.com/reports/uk-retail-market-opportunity-report-may-2014 [30 March 2015]

Prinsloo (2015:2) supports Deloitte Touche and cites e-marketer (2014) that Asia, North America and UK constitute 90% of global e-commerce. The author adds that 15% of retail spend in the UK is attributable to online purchases which is expected to increase to 25% by the year 2020. Globally, retailers have geared themselves for the omni-channel evolution.

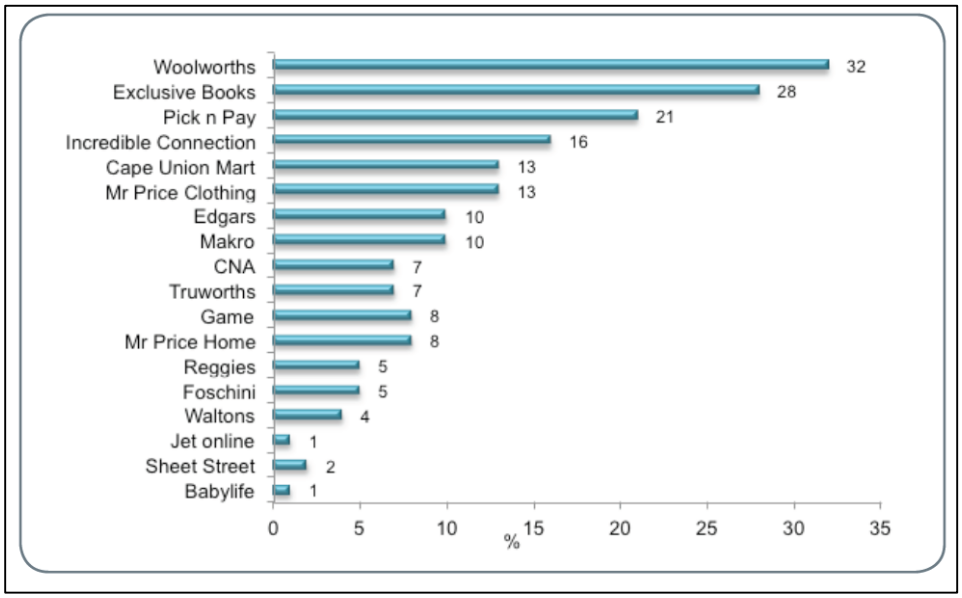
2.3 Nature of the study

E-commerce is quickly gaining momentum in UK, US and the BRIC countries whilst it is growing at a steady rate in South Africa owing to the high cost of broad band and logistics challenges (PWC, 2012:21). Despite these challenges reported by PWC (2012), Prinsloo (2015:3) reports that certain segments of the South African market have surpassed the projected total online usage for Africa. Furthermore, the number of online users were reported to have increased by 25% in 2012 due to South African consumers across living standard measures (LSMs) using m-commerce (PWC, 2012:21).

M-commerce is described as the use of wireless mobile phones and tablets to conduct electronic business transactions via websites or smartphone applications (Levin and Taylor, 2014:759). Although the number of online users have increased due to the growth of m-commerce, the electronic payment system via credit card remains a challenge (Prinsloo, 2015:6). Alternative payment methods such as electronic funds transfer (EFT), cash on delivery/pick up and Paypal are being utilized despite the constant challenge of internet identity fraud. According to Frontera (2013), retailers need to ensure online channels are secure and customers need to trust these channels. Furthermore, courier delivery of orders to customers' homes poses a financial challenge to courier companies and customers, especially in outlying areas. According to Simon (2014), a considerable portion of South African customers have difficulty with the conveyance of products as it is time consuming and expensive. The author further states that omni-channel retailing must facilitate convenient shopping using integrated cross channel order fulfilment.

Urban Studies (2014) conducted research in the South African metropolitan areas on South African online retail trends. The study found that approximately 54% of respondents whom shop online prefer click and collect, whilst some respondents preferred to research online and buy in-store. Urban Studies (2014) further revealed that in South Africa, clothing bought online, in-store and a combination of both comprised 10%, 60% and 30% of purchases respectively. Of the 40% of online and mixed purchases, 79% preferred door to door delivery by courier rather than registered post as the deteriorating postal service has struggled to absorb the workload in South Africa (Prinsloo, 2015:8) and were reported to have high theft levels (PWC, 2012:21). Figure 2.2 illustrates, that the most popular clothing sites used in the 2014 period in South Africa in order of most used site was Woolworths, Mr Price, Edgars, Truworths, Foschini and Jet (Urban Studies, 2015:6). Two key finding by Urban Studies (2014) is that online shopping offers convenience, product range, security and speedy delivery and that 46% of non-online shoppers in South Africa expect to utilize online channels. The adoption of omni channel retailing offers potential for the South African retail industry to experience a significant growth as with UK and US.

Figure 2.2: Retail websites used by South African shoppers

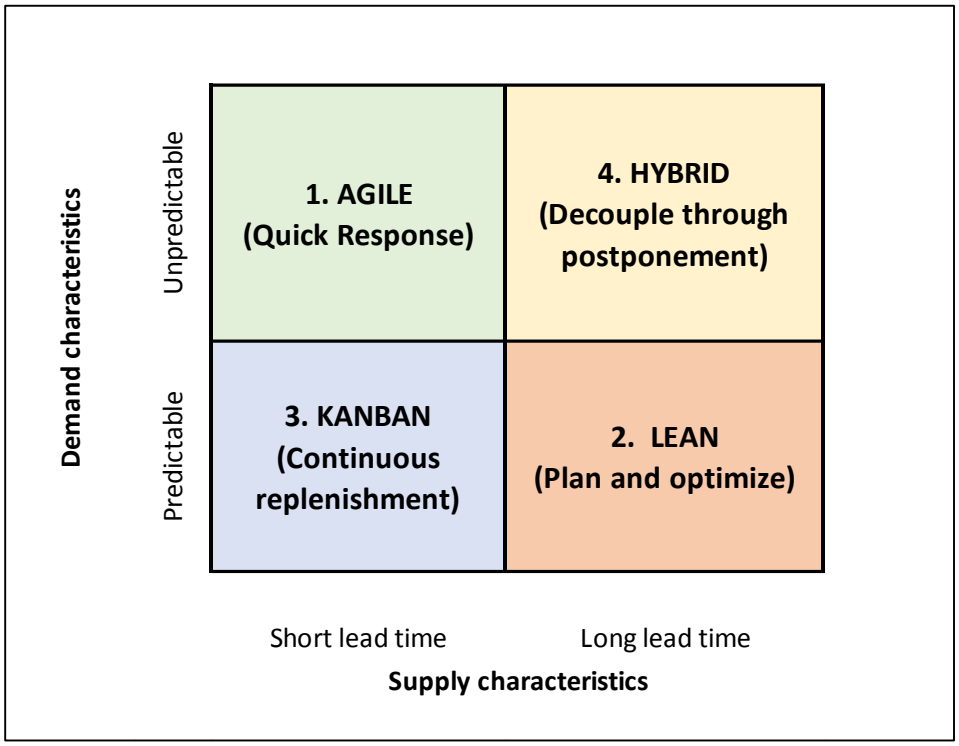


Source: Urban Studies. (2015) *Omni-channel retailing: Changes, trends and strategies.* [Online]. Available: http://www.urbanstudies.co.za/wp-content/uploads/2015/03/SACSC-Onmi-channel-report-2015.pdf [22 August 2015]

2.4 Theoretical Framework

The push and pull theories are adopted when the process of supply and demand matching is undertaken to achieve order fulfilment (Christopher, 2005:117). Under the push theory, the anticipatory business model is used when demand is unknown, hence, inventory distribution decisions are based on forecasts under a make to stock environment (Bowersox *et al.,* 2010: 12). As depicted in quadrant 2 of figure 2.3, when demand is characterised as being predictable, volume demanded is high and long lead times exist, a lean strategy is adopted to plan and optimize operations to create efficiencies (Christopher, 2005:117) and (Rossin, 2012:7). Gattorna (2010: 198) states that a lean strategy follows the push theory since there are larger volumes and longer lead times in which alignment is needed within the supply chain to smoothen product flow and reduce errors. As a result of poor demand visibility and long lead time, a supply chain using the push theory takes long to react to change in demand resulting in a variance between inventory produced and distributed and true demand which is attributable to the bullwhip effect (Simchi-Levi *et al.,* (2008:189). Excessive inventories may become obsolete and service levels may be compromised. Mahapatra, Mahmoodi and Yu (2011: 4713) cite the views of Kim *et al.,* (2002) and Closs *et al.,* (1998) that a push theory achieves low fill rates in comparison to the pull theory when there is a high level of demand uncertainty and lead-time variability.

Figure 2.3: Supply chain strategies

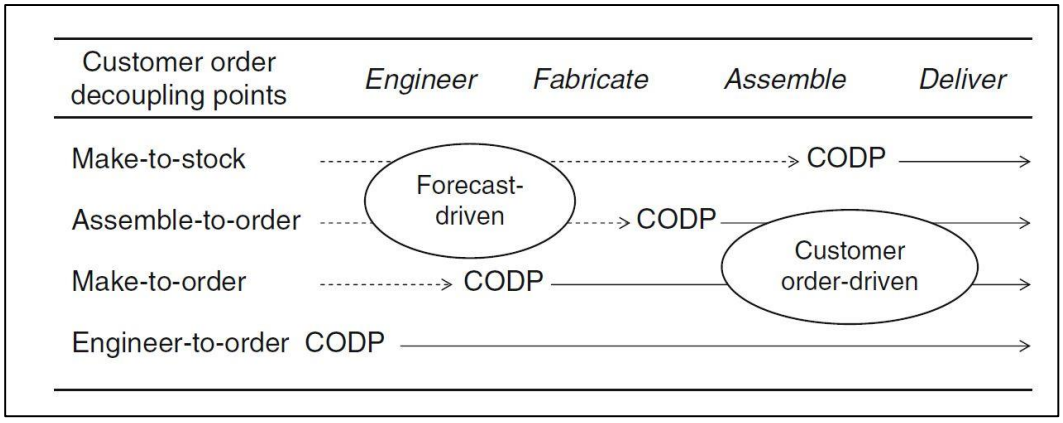


Source: Christopher (2005). Logistics and Supply Chain Management: Creating Value-Adding Networks. 3rd edition. Britain: Pearson Education (pp. 119)

The pull theory is applicable in a reactive environment, using the responsive business model, whereby demand is known due to information sharing and supply chain visibility with the purpose of quick replenishment as the goal (Wisner and Stanley, 2008:375). As depicted in quadrant 1 of figure 2.3, an agile (quick response) strategy is adopted when demand is characterised as being unpredictable, volume demanded is low and short lead times are required (Christopher, 2005:117). Bowersox *et al.*, (2010:16) add that collaborative relationships need to be established for an agile strategy to work. Using a JIT scheduling process and a make to order environment, the pull theory aligns inventory supplied to inventory demanded to facilitate high fill rates and elevated customer service levels through rapid fulfilment of demand using the quick response strategy (Zylstra, 2006:185) and (Rossin, 2012:8). JIT scheduling is concerned with having the required tasks completed exactly on time as intended (Alvarez-Perez, Fowler and Gonzalez-Velarde, 2009:445) whilst JIT levelled distribution scheduling is concerned with matching supply with demand to ensure customers are given their orders in full and on time (Chamber *et al.*, 2007:482) and (Cachon and Terwiesch, 2009:208). Smaller quantities are despatched to stores more frequently to reduce inventory holding costs and respond to changes in demand by adjusting the quantity stock keeping units (SKUs) (Chamber *et al.*, 2007:482).

Whilst the pull theory does not achieve economies of scale since inventory is not planned, it eliminates the challenges accompanied by the bullwhip effect due to true demand being rapidly fulfilled. (Simchi-Levi *et al.,* 2008:190). The hybrid theories, known as the pull-push theory and push-pull theory, exists with a boundary which allows the principles of push and pull theory to be used (Mahapatra *et al.,* 2011: 4699) thereby capitalizing on the advantages of the push and pull theory without the accompanying disadvantages of each theory (Rosin, 2012:8). When demand is predictable and lead times are short, the continuous replenishment strategy know as Kanban functions under the pull-push theory where each product is replenished as it is consumed, as shown in quadrant 3 of figure 2.3 (Gattorna, 2010: 170). The push-pull theory is used when lead times are long and demand is unpredictable as depicted in quadrant 4 of figure 2.3. The supply chain has to become decoupled to implement lean and agile strategies respectively to accommodate for long lead times and unpredictable demand. The decoupling point of a push-pull theory is based on true demand and is also referred to as the customer order decoupling point (CODP) (Olhager, 2012:37). Figure 2.4 illustrates that the CODP can be found either upstream or downstream in the supply chain and is dependent on when the product becomes tied to the customer. In respect of materials flow, engineer to order, make to order, assemble to order and make to stock strategies are adopted based on CODP.

Figure 2.4: Customer order decoupling point (CODP)

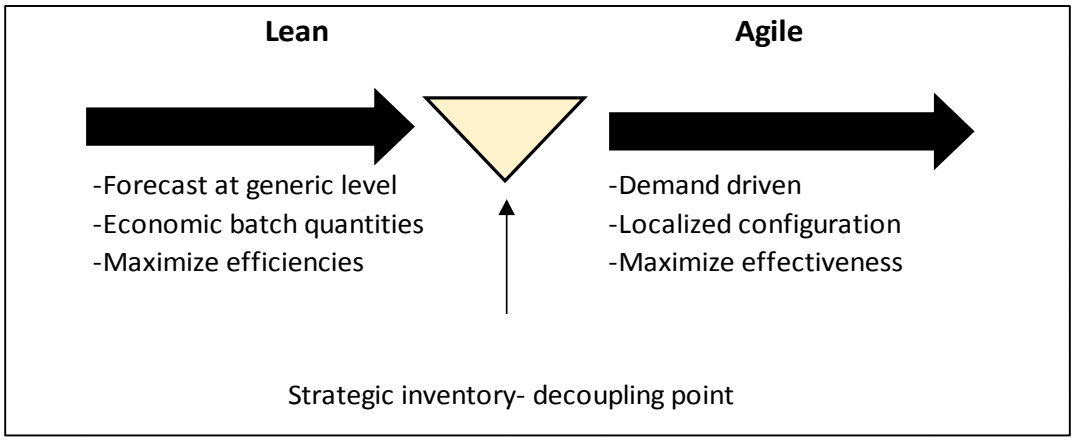


Source: Olhager (2012). Modelling value. 1st edition. Britain: Pearson Education (pp. 38**)**

When product configuration cannot be delayed upstream, distribution is postponed by storing inventory in a central location and distributing it only when true demand is known (Christopher, 2005:120) and (Bowersox *et al.,* 2010: 15). Mahar and Write (2009: 3063) add that postponement is classified as form postponement and time postponement. The former refers to delayed configuration and the latter is applied when deliveries are delayed until demand is known.

Time postponement occurs in a make to stock environment where stock is forecast, produced and stored until demand is known and pulled by customers, unlike in a make to order environment which is solely customer driven. As illustrated in figure 2.5, a customer order decoupled strategy utilizes a lean strategy and an agile strategy which Olhager (2012:40) refers to as 'leagility'.

Figure 2.5: Decoupling point



Source: Christopher (2005). Logistics and Supply Chain Management: Creating Value-Adding Networks. 3rd edition. Britain: Pearson Education (pp. 120)

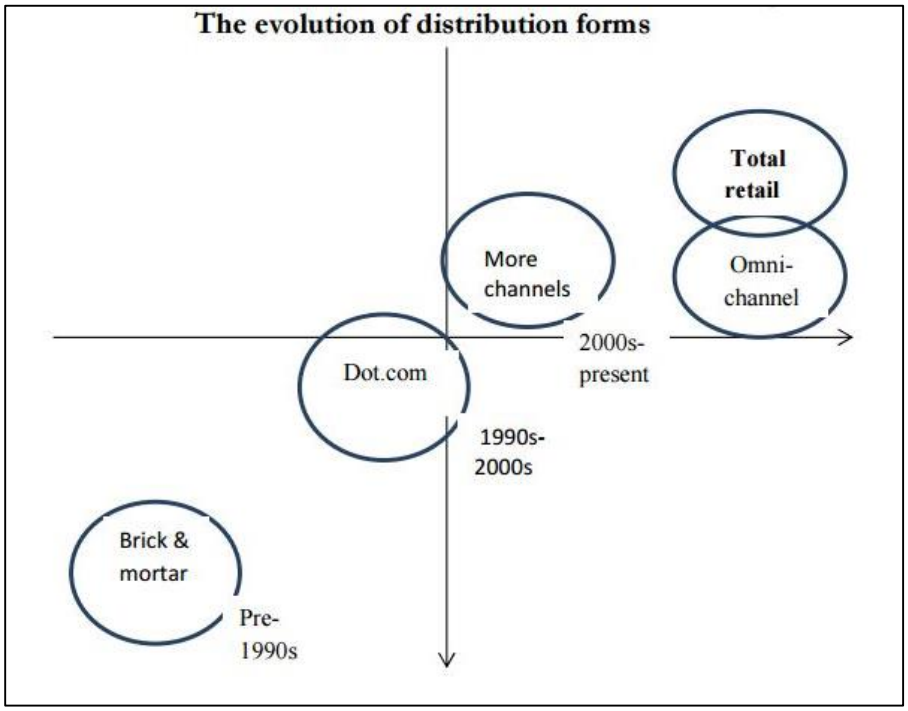
The "leagile" strategy seeks to follow lean principles up to the de-coupling point and agile practices thereafter. The push-pull boundary is the interface where the firm shifts from managing the supply chain using the push theory, to using the pull theory (Rossin, 2012:8). Mbhele (2014) describes the decoupling point as a strategic point for buffer stock and inventory positioning, which changes its position depending on the variability in demand, product mix and clock-speed. An increase in product mix and fluctuating volume would force the decoupling point to move upstream, making the supply chain system more agile to ameliorate the magnified oscillations upstream (Mbhele, 2014). Shorter lead times are thereafter needed and quick response strategies are implemented to get the order to and from the warehouse or distribution centre to the customer (Christopher, 2005:120) and Olhager (2012:40). According to Mahar and Write (2009:3061), fulfilment decisions should be postponed to ensure more informed decisions are made when demand is known and inventory can be delivered when needed. Mahapatra *et al.,* (2011: 4713) are of the view that a supply chain which is characterised as having high levels of demand uncertainty and lead-time variability achieves a higher fill rate when using the push-pull hybrid theory.

In line with the views of Christoper (2005), Cachon and Terwiesch (2009), Rossin (2012) and Olhager (2012), supply chains are decoupled through time postponement, using the push-pull theory to manage demand uncertainty and lead time variability. Under the push theory, inventory is produced under a make to stock environment to achieve economies of scale and to cope with long lead times until inventory reaches the CODP. At the CODP true demand is known and JIT distribution is used to fulfil orders pulled by customers in full and on time.

2.5 Traditional distribution to omni-distribution

Distribution has evolved from the traditional brick and mortar and pure play distribution to multi-channel distribution, followed by a leap into the omni-distribution age, as illustrated in figure 2.6. Prior to 1990, physical stores, now referred to as brick and mortar, offered limited product choice whereby customer demand was only satisfied with on hand inventory (Tetteh and Xu, 2014:1). Between 1990 and 2000, the digital age emerged with the arrival of pure play retailers and the expansion of brick and mortar retailers to digital platforms (Belu and Marinoiu, 2014). Subsequent to the year 2000, retailers offered multiple channels which existed independent of each other. The multi-channel approach offers the benefit of each channel yet inventory was limited to each channel due to a lack of system wide integration (Tetteh and Xu, 2014:2). Consumers' need for a single brand experience, additional choice and quick delivery from buying across channels ensued the omni-channel evolution (Kilcourse, 2013). Retailers are now expected to fulfil orders from and accept returns to distribution centres, stores and vendors whilst having complete visibility and flexibility to manage inventory across all channels (Fortna, 2015:2).

Figure 2.6: The evolution of distribution forms

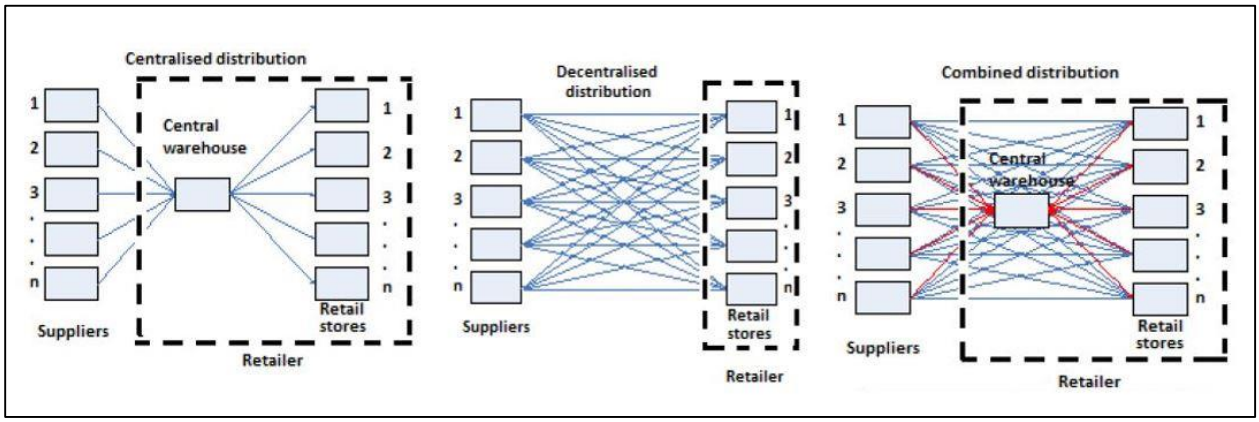


Source: Belu and Marinoiu (2014) 'A new distribution strategy: The omni-channel strategy'. *The Romanian Economic Journal, 52(1):117-134.* (2014) [Online]. Available: http://www.rejournal.eu/sites/rejournal.versatech.ro/files/articole/2014-10-14/2987/belumarinoiu.pdf [22 August 2015]

2.5.1 Traditional distribution -Centralised, decentralised and hybrid distribution

Supply chains are driven with the purpose of supplying the customer optimally. However, poor order fulfilment, route planning and co-ordination of deliveries to brick and mortar and customers are likely to increase distribution and logistics costs (Radovanovic and Zivotic, 2013:279). The inventory distribution function therefore plays a pivotal role in fulfilling orders whilst managing supply chain costs. Baker (2008: 4-6) defines a distribution centre as an outbound node in the supply chain which is responsible for the rapid sortation and movement of inventory from supplier to the customer. Figure 2.7 indicates that inventory distribution can occur either from using a centralised, decentralised or hybrid distribution strategy.

Figure 2.7: Centralised, decentralised and hybrid distribution



Source: Radovanovic and Zivotic. (2013) 1st Logistics International Conference, *Setting up centralised distribution.* [Online]. Available: http://logic.sf.bg.ac.rs/wp-content/uploads/Papers/ID-50.pdf [27 August 2015]

A centralized strategy encompasses the delivery of inventory by suppliers to a single location for the entire supply chain whereby the budget and resources are allocated across the network with deliveries made in full loads (Radovanovic and Zivotic (2013:279). A centralized strategy achieves global optimization which is concerned with a system wide strategy being utilized across facilities and processes to achieve an outcome that is optimal for the supply chain. In addition, risk pooling is possible through the aggregation of demand from multiple regions thereby reducing demand variability and the likelihood of the bullwhip effect. In contrast, decentralized distribution entails delivery being made by many suppliers to multiple facilities thereby achieving local optimization as each facility functions in isolation of the other (Simchi-Levi *et al.*, 2008:231). Decentralized distribution is useful when the retailer has limited capacity for stock and short lead times are required as lead time is significantly shorter in decentralized distribution since the facility is in closer proximity to the customer hence response time is shorter (Radovanovic and Zivotic, 2013:281). A hybrid distribution strategy comprises part centralized and part decentralized distribution. Delivery flow can follow a many to many relationship from suppliers to facilities as well as a many to one relationship. In addition to a hybrid strategy achieving the benefits of centralized and decentralized strategy, transhipment can occur between facilities if there is visibility and information sharing (Simchi-Levi *et al.*, 2008:231). In addition to the views of Simchi-Levi *et al.*, (2008:51-52), Schmitt, Shen, Snyder and Sun (2014:2) are of the view that whilst a centralized system facilitates risk pooling, a decentralized system facilitates risk diversification due to disruptions affecting a single facility.

2.5.2 Multichannel distribution

In a multichannel distribution strategy, the customer is offered in-store and online purchase channels which exist independently from each other and are serviced from traditional and virtual distribution centres respectively (Foster, Lewsi and Whysall, 2014:44). Whilst online channels achieve inventory pooling for retailers due to a broader product assortment offered to customers compared to in-store inventory (Agatz, Fleischmann and Nunen, 2008:342), Kearney (2013:1) found customers continue to enjoy shopping in-store as they acquire their items immediately rather than awaiting delivery of online orders. Online channels are also extending to brick and mortar platforms whereby online orders can be picked up from dedicated brick and mortar stores servicing the online store (Agatz *et al.,* 2008:343). Foster *et al.,* (2014:46) add that customer pick up is viable as it reduces e-fulfilment costs. Owing to high distribution and transportation costs, inventory deployment needs to be planned. As an alternative to traditional centralised and decentralised online and store distribution, integrated fulfilment may be used which necessitates that e-fulfilment and store fulfilment be made through the same distribution centre (Agatz *et al.,* 2008:348). Liu, Zhang and Zhou (2010:218) add that integrated fulfilment provides the benefits associated with risk pooling. Foster *et al.,* (2014:47) add that the traditional distribution has to be redesigned to accommodate online orders as boxes have to be opened and items picked and repacked for delivery to the customer. Online retailing presents the opportunity for drop shipment in a hybrid distribution strategy for multichannel retailers whereby brick and mortar functions are fulfilled from a centralized distribution and online sales are fulfilled through the use of drop shipment (Agatz *et al.,* 2008:353). Whilst the multichannel strategy offers in-store pick up and customer delivery, cross channel capability is limited due to each channel functioning in isolation of the other (Tetteh and Xu, 2014:2). This limitation creates the need for cross channel usage with system integration which is achieved through omni-distribution.

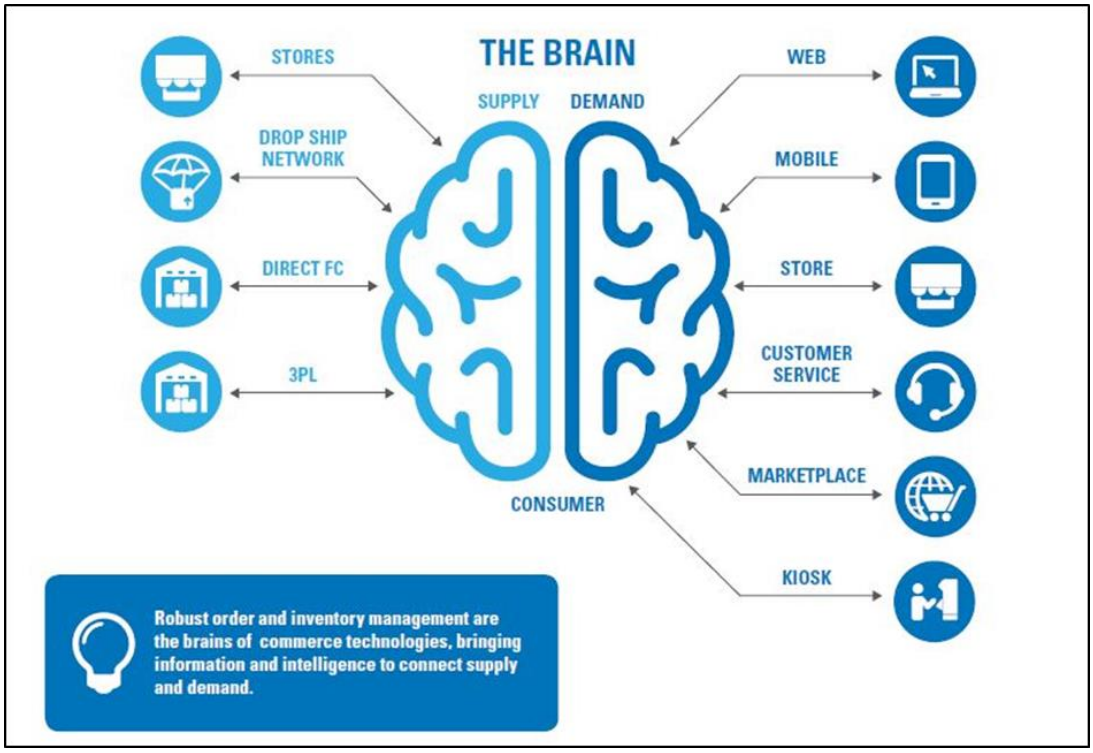
2.5.3 Omni- distribution

Omni-distribution is the fulfilment of customer orders from a myriad of channels integrated by one system with visibility of the location of the item and delivery date at a price that is acceptable to the customer and profitable by the retailer (Mcbeath, 2014:2). Fortna (2015:2) defines omni-distribution as the capability to fulfil orders from and accept return to distribution centres, stores and vendors whilst having complete visibility and flexibility to manage inventory across all channels. Omni-distribution is an evolved form of multichannel distribution as distribution occurs from multiple channels due to the integration of the entire inventory system. The retailer has the capability to fulfil an order in full and on time whilst considering cost using omni-distribution as it has end to end visibility of the location of each item in supply chain.

Retailers using an omni-channel approach can physically fulfil orders from four types of facilities: combined distribution centre, separate store fulfilment for online and in-store orders, combined store fulfilment and hybrid fulfilment (McCrea, 2014:57). Firstly, a combined distribution centre which services all channels achieves economies of scale since the fixed cost per unit is reduced as more units are distributed out of the single facility. However, the use of a combined distribution centre may be limited by long lead times since there is a greater distance between a central distribution centre and the destination in comparison to the distance between multiple decentralised distribution centres and the destination. Secondly, the use of separate store fulfilment for online and in-store orders achieves shorter lead times. However, it requires greater inventory management across the network.

Thirdly, combined store fulfilment for in-store and online customers achieves shorter lead times yet fewer economies of scale and greater stock management at store level. However, stores can be leveraged for e-fulfilment if there is optimal inventory visibility across the omni-distribution network (Supply Chain Digest, 2015:6). Fourthly, hybrid fulfilment presents an alternative option which utilizes a combination of the first three fulfilment facilities based on location and SKU segmentation. McCrea (2014:57) adds that all channels should be supported simultaneously through system wide visibility and inventory sharing. Sonier (2014:3) is of the view that order management is needed to achieve system wide visibility and inventory sharing in an omni-channel. Figure 2.8 depicts centralized inventory systems which connect demand to supply using multiple integrated distribution channels. Fortna (2015:2) adds that while order management is mature, the growth of e-commerce creates the need for integrated inventory systems with visibility of inventory and demand across all channels. Fortna (2015:3) supports Sonier (2014:3) that in an omni-channel approach all channels share inventory and picking systems within the warehouse or distribution centre.

Figure 2.8: Order Management



Source: Sonier, E-bay Enterprise. 2014. *Omnichannel Commerce Brings Order Management to the Forefront*. [Online]. Available: http://www.ebayenterprise.com/commersations/publications/omnichannel_commerce_brings_order_management_to_the_forefront/ [13 January 2014]

Sonier (2014:3) identifies four significant purposes of an order management system. Firstly, it provides end-to-end control and a unified view of the entire process, dynamically linking network inventory with demand from supplier to consumer. By leveraging global supply visibility, order management acts as the mediator to ensure orders from all channels are fulfilled. Secondly, it directs orders to the correct supply source, following retail optimizing sourcing rules. Thirdly, it facilitates fulfilment and delivery of orders by vendors, distribution centres and stores using built in tools. Fortna (2015:2) states that "a strong order management system should balance factors like order fill rate, service levels, delivery times and freight costs to make decisions about how to allocate inventory and service the customer. Systems should support the goal of keeping inventory flexible for as long as possible to fulfil demand regardless of which channel it comes from". Inventory optimization in omni-channel retailing requires flexible, integrated inventory management systems to support a high level of precision and speed from supplier to customer.

Fourthly, the distribution component of order management, requires a ship-from-store strategy to reduce transportation costs and lead time. Store based fulfilment creates a virtual distribution centre across the retailer's network of physical stores. The author adds that it is beneficial since stores assets are leveraged and delivery times and shipping costs are reduced. The order should be sent to a specific store based on the following routing logic: proximity to the customer, inventory levels at stores, an order limit per day per store, complete shipment from a store, special handling and route selection of the next best store using the Distribution Order Management System. This strategy helped Macy's achieve a sales growth of $1 billion every year from 2010-2013 (Sonier, 2014).

In addition, Sonier (2014:5) states, to support order management and to become globally competitive, digital innovation is needed in supply chains. Systems therefore need to be compatible, provide real time visibility of inventory location and support cross channel buying. The customer service agent, sales associate and customer should be able to determine the closest location of the stock, lead time to fulfil the order and cost of shipping.

2.5.3.1 Challenges multi-channel retailers faced when deploying an omni-distribution strategy

Forrester Consulting conducted a study, primarily in the US and in Europe, identifying the challenges multi-channel retailers faced when deploying an omni-distribution strategy (Forrester, 2014). Firstly, investment in technology is essential in maintaining visibility of inventory, costs and customer purchase history. Secondly, fulfilment strategies are becoming brand differentiators as companies provide same day deliveries, delivery to the customer's home, free delivery with the promise of the order being delivered in full. Thirdly, retailers have become comfortable with their existing omni-channel strategies however, consumer expectations are becoming heightened and service levels are becoming elevated amongst competitors. Fourthly, integration amongst organisations and technology is becoming more necessary. The author reported that 71% of customers in the study said that inventory visibility of in store products is essential and they would visit the store if product availability was visible on the website. However, only 32% of retailers in this survey offered this capability. Inventory visibility is therefore crucial to stakeholders but is also becoming just as important to the connected consumer since they expect less interaction, more customisation and quicker deliveries. World Trade 100 (2014:16) supports this view stating that inventory will have to be available in most markets, hence more facilities will be needed or centralised facilities will have to relocate closer to parcel carrier hubs to improve lead time. Omni-distribution appears to follow a hybrid approach to distribution whereby stock can be replenished from any facility if inventory and information systems are integrated across all channels to link network inventory with demand.

2.6 Omni-distribution/logistics network

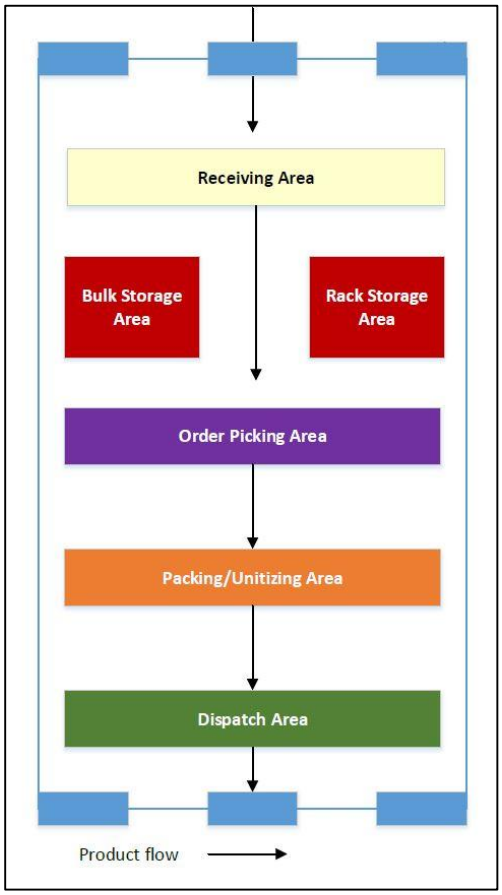
2.6.1 Warehousing vs distribution functions

In a traditional warehouse, inventory is received, stored, sorted and redistributed at a later stage (Simchi-Levi, *et al.*, (2008:231). In addition to traditional storage functions, warehouse management systems provide product information such as status, condition and nature of the product (Nieman, Nieman and Villiers, 2012:4). According to Radovanovic and Zivotic (2013:281) within a distribution centre, inventory is received, cross-docked or sorted, consolidated and delivered to stores as a single or full load. There is therefore a difference between warehousing and distribution. Warehousing is concerned with inventory storage over a long period compared to distribution which is concerned with sorting and movement of stock. The distribution centre has a faster inventory turnover than a warehouse. Some companies may have a combined facility to utilize distribution functions such as sorting and cross dock and warehousing functions such as storage, picking and distribution.

2.6.1.1 Warehousing

Warehouses hold inventory either as raw materials, work in progress, finished goods or a combination of all three (Nieman *et al.*, 2012:57). For the purpose of this study, only finished goods warehouses, also known as outbound warehouses, will be discussed. According to Nieman *et al.*, (2012:56) warehousing is responsible for three key functions: movement, storage and information transfer which follows product flow depicted in figure 2.9.

Figure 2.9: Basic warehouse design and with product movement



Source: Nieman et al., (2012:61). Strategic logistics management. 5th edition. Pretoria: Van Schaik Publishers

The stock movement in the warehouse occurs at inbound and progresses to storage and dispatch. At inbound, inventory is unloaded and received from the supplier into the warehouse. Orders are received from suppliers with supporting documentation whereby the ordered quantity is verified against the delivered quantity (Lahmar, 2008:23). Upon the receiving clerk completing the administration, stock is sorted to be moved to put-away for storage into the locations as per the location classification master. According to Agatz *et al.,* (2008:349), two-part warehouses are utilized for order picking and to hold reserve stock. Reserve stock is given a code and placed into the necessary location through item put-away. It is important that the corrected stock be posted into the correct locations to ensure stock can be easily found (Nieman *et al.*, 2012:70).

Storage can be temporary, permanent or semi-permanent based on usage and the quantity of buffer stock. Item put-away can follow a dedicated approach whereby the SKU is always assigned to a fixed location (Lahmar, 2008:24). Alternatively, the SKU can be assigned to a location arbitrarily or it can be grouped with other items with similar characteristics. Grouping and fixed location allocation are presumably more organised and facilitates more efficient pulling from the location in comparison to arbitrary allocation.

Order picking comprises a large percentage of warehouse operating costs particularly in the case of e-fulfilment where there are multiple small pick quantities resulting in split case picking being used commonly rather than full case picking (Agatz *et al.,* 2008:349). Discrete order picking, zone picking, batch picking, wave picking and a combination of each, namely; Zone-Batch Picking, Zone-Wave Picking and Zone-Batch-Wave Picking, are amongst the common order picking methods (Trifactor, 2008). The alternatives present trade-offs between accuracy, time and cost. Whilst discrete order picking achieves a high fill rate, a significant amount of travel time is used. In comparison wave picking is very similar with the exception that the pick is scheduled to co-ordinate shipping operations. In contrast, zone picking is time efficient yet may succumb to pick inaccuracies as orders pass through the zone. Alternatively, batch picking maybe used to pick SKUs into multiple orders but is limited pick profiles with fewer SKUs with smaller dimensions. Bowersox *et al.,* (2010:284) support (Agatz *et al.,* 2008:349) stating a large number of small orders need to be processed for e-fulfilment.

The layout of the warehouse is necessary in maintaining flow of inventory between departments to effectively meet demand whilst ensuring that costs associate storing and handling are minimized (Lahmar, 2008:62). The storage area comprises multiple locations in which stock keeping units (SKUs) are classified when establishing the layout. According to Nieman *et al.,* (2012:61) critical storage items are given preference when determining the layout through the use of slotting rules. Strategic items and profitable items are stored in strategic locations as well. Fast-moving items are classified by usage rates and are located closer to the distribution point. The rate of location usage is a key contributor to cycle time as the workflow of activities and the layout influence efficiency of stock movement. In addition to inventory location, material handling and equipment decisions need to account for factors such as equipment utilization, safety, adaptability and cost minimisation in the layout plan (Lahmar, 2008:73). Exit routes and clear demarcations are needed as well as fire monitors and sprays. Forklifts which require wide isles are needed for heavy and tall items and hazardous and dangerous items are stored in a separate location. Furthermore, time and space need to be optimized for fast stock flow and minimal cost per unit through the use of storage racks and high level storage.

Zone-batch picking is used for one unit orders for enhanced productivity (Nopolitino, 2013:53). If there is an assortment of SKUs then the facility has to consolidate online orders. Furthermore, flexibility is required for individual item picking. Fortna (2015:5) suggests that retail replenishment profiles be established and compared across channels to determine if there is similarity between profiles so that pick modules can be shared to reducing excess stock and enhancing picking efficiencies. In addition, inventory can be classified by static and dynamic pick locations based on SKU movement. Fast moving SKUs are classified into a static pick location and slow moving SKUs classified into dynamic location using slotting logic to balance pick productivity with space utilization. Rapid, efficient and accurate picking is needed with the co-ordination of labour and wave volume by work zone to achieve a high fill rates (Alexander (2014:25). Agatz *et al.,* (2008:349) add that the accuracy of high volume picks is supported by picking technology like radio frequency identification (RFID), pick/put-to-light, and wireless speech devices. Whilst Fortna (2015:9) add that sorters such as Bombay sorters, tilt-trays and cross-belt be considered as well as goods-to-person technology such as carousals to enhance picking efficiency, they are also of the view that the technology has to suit the environment and operation to achieve a balance between flexibility, performance and cost. Once an order has been assembled, it is moved onto equipment to be processed for dispatch to the customer or store (Nieman *et al.,* 2012:70). The stock needs to match the despatch note to ensure the order is correct. Various methods of delivery and route optimization techniques are used for the last mile of the supply chain, transportation and delivery. Each warehousing process is accompanied by information transfer. Inventory can be stored temporarily for quick replenishment or for a moderate to long term based on demand. Information transfer occurs at every process in the warehouse. Information such as the status, condition and nature of the product as well as inventory levels, throughput, stock keeping locations and customer data is available on the warehouse management system (WMS).

2.6.1.2 Distribution (Cross dock)

Distribution is facilitated through the cross-dock function of receiving, sorting and transfer of inventory between the inbound and outbound door usually within 24 hours (Lahmar, 2008:154) to facilitate JIT distribution scheduling (Alvarez-Perez *et al.,* 2009:554). Using a cross dock process, inventory cost, inventory levels and lead time is reduced significantly whilst throughput is increased. Nieman *et al.,* (2012:72) add that handling is minimal and storage is eliminated as stock is received pre- allocated as a replenishment order from the retailer or planner in the supply chain. Warehouse management system (WMS) and warehouse control system (WCS) facilitate the movement and sorting of inventory using conveyors and automated cross dock sorters to the outbound door for dispatch via the transport carrier.

2.6.1.3 Handling and packaging

As a result of poor inventory handling and severe product damage, supply chains aim to reduce product handling and movement. Inventory packaging is designed for the consumer from a marketing perspective and it is designed for logistics (Bowersox *et al.*, 2010:30). From a logistics perspective items may be unitized by being grouped into cartons, bags, bins or barrels to reduce product damage and increase handling efficiency. Fortna (2015:5) add that SKUs be consolidated and product packaging be postponed to reduce handling as well as packaging and transportation cost.

2.6.1.4 Warehouse/ Distribution Centre fulfilment metrics

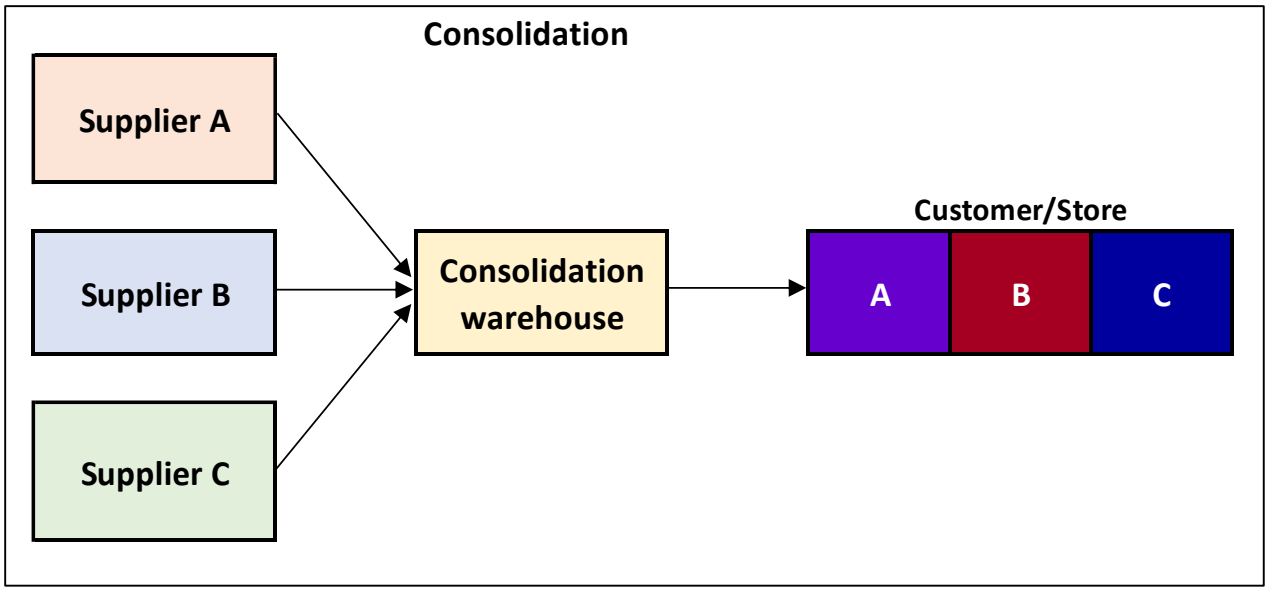
The top three fulfilment metrics accentuated by Arnold and Reese (2015:2) are order accuracy, order cycle time and production pick rates. Order accuracy is the quantity of error free orders as a percent of total orders shipped (Christopher, 2005:76). This metric is closely associated with fill rate. If an order is not delivered in full due to the order not being fulfilled one hundred percent, the quantity of error free orders are reduced, hence order accuracy of the warehouse/ distribution centre is smaller. Arnold and Reese (2015:4) suggest that in-transit time between receipt and posting of stock into the warehouse location should be reduced to minimize the misplacement of stock. In addition similar SKUs are grouped and high velocity SKUs allocated to a larger location to avoid compromising inventory flow. Furthermore, ergonomics in a warehouse affect order accuracy.

The height of the shelf with pick cartons and weight of the item being picked may distract the picker resulting in inaccurate picking. The pick and pack areas therefore have to be conducive to ensure orders are fulfilled accurately. Order cycle time is variance between the customer order date and the date the order was shipped from the warehouse/ distribution centre which impacts directly on on-time delivery (Arnold and Reese, 2015:2). Complementary product slotting is used to improve pick rates and reduce cycle time. Production pick rates divides the quantity of units picked over the hours that were worked in a warehouse (Arnold and Reese, 2015:2). Unnecessary activities are considered to be waste and need to be eliminated from the process. Order accuracy is compared to production pick rates to ensure speed is not compromising accuracy. The efficiency of warehousing and distribution operations consequently inhibit or expedite perfect order fulfilment is achieved.

2.6.1.5 Decoupling point in distribution

In response to the volatile retail environment, supply chains become decoupled, separating lean manufacturing activities from agile activities downstream (Baker and Canessa, 2009:425). Consolidation and delayed differentiation strategies are used to synchronise supply to demand as depicted in figures 2.10 and 2.11 respectively. Consolidation facilitates inventory pooling and achieves shorter in-transit time between the facility and store compared to delivery from the supplier to all stores (Cachon and Terwiesch, 2009:340). Bowersox *et al.*, (2010:247) support this view and add that this type of strategy is in line with the JIT distribution concept of distributing stock when needed due to an increase in the frequency of trips to stores. Cachon and Terwiesch (2009:340) restrain that this strategy is useful if total demand is less variable than demand at each store.

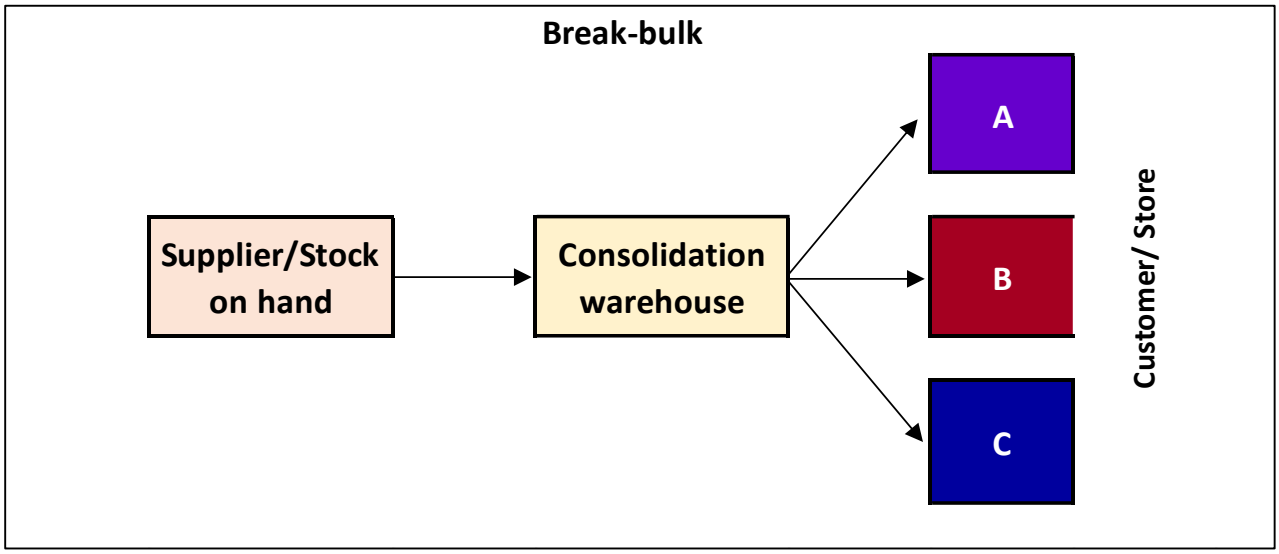
Figure 2.10: Consolidated distribution



Source: Bowersox *et al.*, (2010: 249). *Supply chain logistics management*. 3rd edition. New York: McGrew Hill

In the case of delayed differentiation, uncertainty associated with product variety is reduced by delaying product customization in a production environment until demand can be observed. This strategy is useful in a make to order environment where customization is quick and inexpensive (Cachon and Terwiesch, 2009:340). In the case of finished goods, distribution is delayed until demand is known. Bowersox *et al.*, (2010:247) make reference to break-bulk operations where large shipments are received and sorted for delivery to multiple destinations when needed, as illustrated in figure 2.11.

Figure 2.11: Delayed differentiation using break-bulk



Source: Bowersox et al., (2010:249). *Supply chain logistics management*. 3rd edition. New York: McGrew Hill

Consolidated distribution and delayed differentiation strategies are both useful in cases where shorter lead times are required in the last mile of the supply chain.

2.6.2 Logistics Network

2.6.2.1 Last mile supply chains

Omni-channel distribution is gaining popularity as the demand for an assortment of SKUs grows (Alexander, 2014:24). To fulfil demand, sophisticated automation is required to facilitate efficient, flexible and integrated picking as well as pack and ship (Alexander, 2014:24). According to Lau (2012:648), a one size fits all supply chain solution cannot be utilized in a demand driven retail environment that is striving to achieve quick response and efficiency. The author adds that the order size and value relative to lead time challenges distribution to aggregate and consolidate orders. A customized solution of matching demand with supply chain distribution is necessary to enhance distribution efficiencies. Using the semi-extended, fully extended, decoupled or centrally extended strategy of the order fulfilment matrix, order fulfilment can occur either from a store or distribution centre and delivery of the order can be made directly to the customer's home or picked up from the store or distribution centre (Boyer *et al.*, 2005:19). World Trade 100 (2014:17) supports Boyer *et al.,* (2005:19) stating that delivery can be made from supplier, 3PL and stores as alternatives to shipping from a centralized distribution centre.

According to Blanquart, Dablanc, Lenzm, Morganti and Seidel (2014:182) European Union institutions have identified that the last mile deliveries are a big component of online sales which contribute to enhancing online sales. Whilst home deliveries are most problematic for retailers, it is the most preferred method of delivery by customers. Lau (2012:648) has made the following recommendations to achieve distribution efficiencies: firstly, a pricing scheme with a surcharge for various delivery options be used to ensure effective utilization of resources, route optimization and product fulfilment. Secondly, delivery stores be demarcated to utilize delivery to the closest store principal. Thirdly, demand be consolidated relative to store groupings. World Trade 100 (2014:17) is of the view that additional staging and packing space as well as fulfilment staff will be needed if store fulfilment and delivery from store to customer is used. However, consolidated deliveries can be made to optimize delivery, achieve successful first time deliveries and reduce operational costs for the transporter (Blanquart *et al.*, 2014:188). Fourthly, extensive supply chain visibility facilitates matching of supply and demand. In addition, order replenishment via vendor managed inventory (VMI) reduces order processing at the distribution centre yet may lengthen in-transit time and increase delivery cost depending on the distance between the vendor and retailer. Lau (2012:648) is of the view that a customized approach to distribution will meet customer service levels as well as achieve distribution efficiency.

Sonier (2014:4) is of the view that online fulfilment from stores (door to store) is more beneficial than using a separate E-commerce DC. As part of an omni-channel strategy using Distribution Order Management System, store based fulfilment creates a virtual distribution centre unifying order processing across the retailer's network of physical stores (Supply Chain Digest, 2015). Napolitano (2013:49) supports Sonier (2014:4) stating that it is beneficial since stores assets are leveraged and delivery times and shipping costs are reduced. Napolitano (2013:49) adds that selected stores can be used as replenishment centres for high volume e-commerce items. Furthermore, Napolitano (2013:49) states that Distribution Order Management System is cost effective and shipment to customer is strategic as it identifies inventory across the network, delivery time frame and most cost effective method of delivery to the customer in keeping with the service level promised to the customer. Sonier (2015:4) adds that the order should be sent to a specific store based on the following routing logic: proximity to the customer, inventory levels at stores, an order limit per day per store, complete shipment from a store, special handling and route selection of the next best store using the Distribution Order Management System. This strategy helped Macy's achieve a sales growth of $1 billion every year from 2010-2013 (Sonier, 2014).

The Park Avery Group (2015:4) supports Sonier (2014:4) stating that it provides an accurate count of every stock keeping unit's (SKU) available to promise (ATP) number and the date the product needs to be delivered to the customer. ATP is a business function that calculates whether orders can be fulfilled based on stock on hand and stock in the pipeline. Distribution Order Management utilises fulfilment logic to service the needs of the customer at the lowest possible cost (Supply Chain Digest, 2015).

2.7 Order fulfilment

Orders begin and end with the customer hence it is paramount to meet their expectations. The Supply Chain Council defines perfect order fulfilment as "A discrete measurement defined as the percentage of orders delivered to the right place, with the right product, at the right time, in the right condition, in the right package, in the right quantity, with the right documentation, to the right customer, with the correct invoice. Failure to meet any of these conditions results in a less than perfect order" (Dwyer, 2015:1). Besides product delivery, customer service elements of on time delivery, order fill rate, product condition and accurate documentation are outputs from the demand driven supply chain for the customer. According to Christopher (2005:65), perfect order fulfilment is quantified by calculating the 'on-time, in-full, error free percentage'. The error-free percentage relates to documentation, labelling and damage. As illustrated in table 2.1, each element is measured and scored as a percentage and all three measures are multiplied together thereafter.

Table 2.1: Perfect order fulfilment

Measure	**Percentage (%)**
On-time delivery	94%
In-full order	100%
Error-free order	95%
Perfect order fulfilment total	**89%**

2.7.1 On time delivery

Customers expect a clear indication of when their order will arrive; they expect to receive same day shipment and for their parcels to be delivered on time either to their private delivery address or in-store (Forrester, 2014:5). According to a study conducted by World Trade 100 (2014:16) online customers value same day delivery to the extent that they will abandon their cart if lead time is too long. A longer delivery time yields lower supply chain customer service.

World Trade 100 (2014:16) is of the view that customer purchasing online or via a telesales agent be offered a choice of delivery speed at a special transportation rate. As customers demand more frequent deliveries within shorter time windows, the deliveries will have to be made by retailers more frequently following the JIT principles (Christopher, 2005:75). Bowersox *et al.,* (2010:54) add to this by stating that speed of delivery is crucial in achieving a quick response strategy and JIT deliveries. Frequent, shorter and quicker deliveries are necessary in agile supply chains when the expected turnaround time is shorter.

2.7.2 Order fill rate (In full)

Order fill rate is a measure of inventory delivered to the customer as a percentage of inventory ordered. High fill rates require high inventory levels yet supply chains are required to remain lean (Bowersox *et al.,* 2010:53). Customer requirements can be fulfilled whilst remaining lean by using multiple strategies.
Firstly, information technology facilitates visibility and information sharing if systems are well integrated. Secondly, customer relationship management is essential and thirdly, postponement strategies can be utilized. According to Forrester (2014:6), customers that elect in-store pick up want to be guaranteed that their complete order has been delivered to the store. In line with the views of Bowersox *et al.,* (2010:53) and Forrester (2014:6), it is necessary that order management system and last mile strategies are integrated to ensure network inventory will satisfy demand in full.

2.7.3 Product condition and accurate documentation

As part of an error free order, documentation, product labelling and damage need to be accounted for in the customer service offering (Christopher, 2005:65). Documentation needs to be correct to ensure in full and on time delivery of the order. Furthermore, inventory packaging is designed for the consumer from a marketing perspective as well as for logistics (Bowersox *et al.,* 2010:30). Packaging and handling at distribution and shipping influences the condition of the product at delivery (Kardar, Farahani and Rezapour, 2011: 175). As a result, if the product is delivered on time but the paper work is not in order or if the product is damaged, the order does not receive a perfect order fulfilment percentage as the service level agreement with the customer was not satisfied. In addition to achieving perfect order fulfilment, value added services such as assembly, sorting and sequencing of items ordered and efficient returns processes heighten the service offering (Kardar, *et al.*, 2011: 217).

2.8 System advancements and visibility

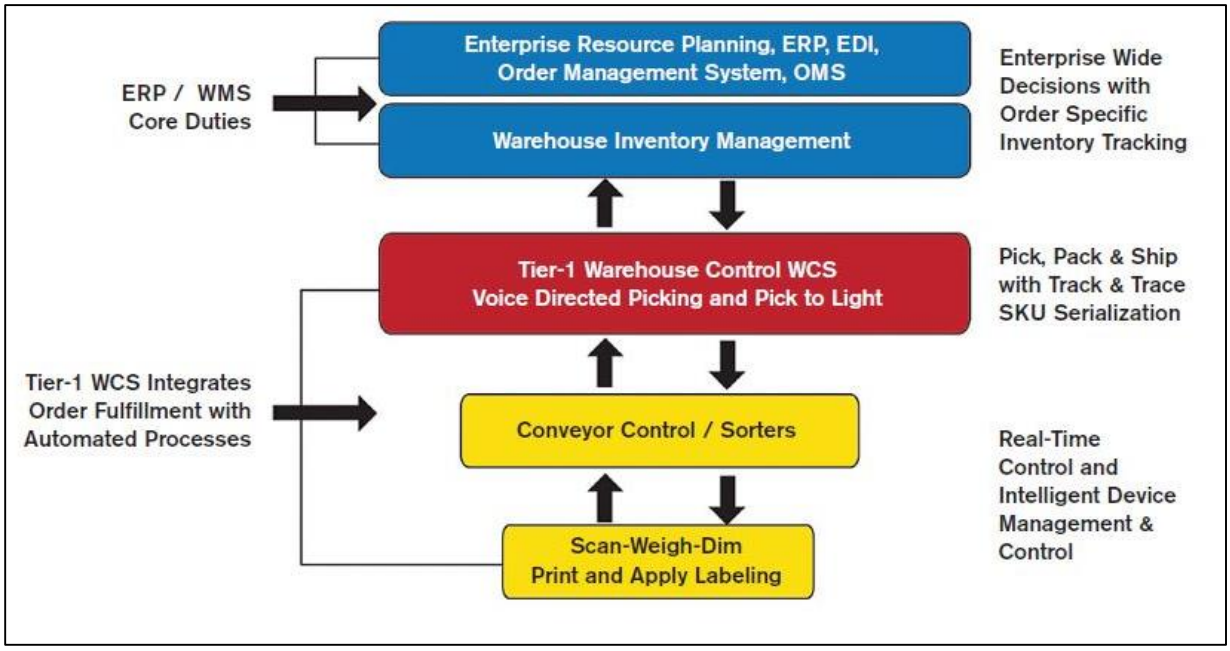
Napolitano (2013:49) states that a successful omni-channel supply chain is dependent on the information system and inventory management system's planning and executing capabilities as well as the extent of system visibility. Belu and Marinoiu (2014:123) support Napolitano (2013:49) stating that the use of integrated information systems in omni-channel retailing is necessary in minimising cost whilst providing a heightened customer experience.

2.8.1 Inventory management systems

2.8.1.1 Warehouse/ distribution centre

Enterprise resource planning system (ERPS) and warehouse management systems (WMS) are required to facilitate pick, pack and ship, labour balancing and material handling automation of full, mixed and split case pallets as part of its general functions (Alexander, 2014:26). The author adds that warehouse control system (WCS) needs to interface the WMS, ERPS and automatic storage and retrieval system(ASRS) to provide advanced picking automation for efficient omni-channel order fulfilment as depicted in figure 2.12.

Figure 2.12: Order fulfilment automation



Source: Alexander, World Trade. *Omni-tasking for omni-channels*. 2014. [Online]. Available: http://connection.ebscohost.com/c/articles/94059082/omni-tasking-omni-channels [22 August 2015]

Alexander (2014:28) cites AL Systems (2011) definition of WCS and WMS: "WCS is a software application that directs the real time activities within warehouses and DCs. WMS encompasses the receipt, storage and movement of goods to intermediate storage locations or to final customer but through non real-time data." Bowersox *et al.*, (2010:263) add that WMS co-ordinates order selection for fulfilment through discrete selection, the preparation of a specific customer's order for shipment, and wave selection, the co-ordination of all items that are needed to complete customers' orders or replenish stores at one time with the shipment destination. Image 2 of the appendix highlights the difference between WCS and WMS. Unique picking and packing rules are applied based on the product classification, for example, fragile items have special picking rules due to the nature of the product (Alexander, 2014:26). Fortna (2015:3) supports Alexander (2014:26) that functions such automated cross docking, optimized wave order release, carton zone routing, dynamic slotting, conveyor sortation, carton weighing, label capture, carton audit and data conveyance are necessary for advanced warehousing functions within the omni-distribution network.

Furthermore, automatic identification and data capture technology (AIDC) such as barcode scanners, optical character recognition (OCR) and RFID monitors and captures inventory flow. The AIDC needs to be integrated with and material handling equipment (MHE) and with the WCS to relay information back and forth in the system (Alexander, 2014:26). As illustrated in figure 2.13, the AIDC and WCS together with the WMS facilitating automated label printing.

Figure 2.13: Automated label printing- integration of AIDC and WCS

Source: Alexander, World Trade. Omni-tasking for omni-channels. 2014. [Online]. Available: http://connection.ebscohost.com/c/articles/94059082/omni-tasking-omni-channels [22 August 2015]

The WMS communicates with programmable logic controllers (PLCs) to control MHE. Sophisticate WCS can operate at single or multiple locations especially with the demand in localized distribution due to the nature of agile supply chains (Alexander, 2014:29). According to Stanley and Wiser (2008:336), an integrated WMS/DMS and Transport Management System (TMS) enhances supply chain effectiveness as cross dock, pick and packing processes are co-ordinated with transportation processes such as truck loading and vehicle routing.

2.8.1.2 Parcel tracking and delivery

Parcel tracking is essential for retailers and customers to maintain visibility whilst the order is in-transit. According to Napolitano (2013:54), integration between the WCS and WMS is crucial in being able to identify, even in the warehouse, where the parcel is. Standardized Numerical Identifier (SNI) such as barcodes or two-dimensional (2D) data codes or RFID tags are applied to the parcels. (Alexander, 2014:29).

Through the integration of the WCS, WMS and TMS, the retailer is able to control the journey of the parcel and the customer can monitor the movement hence establish when delivery is expected as part of the service offering. Furthermore, the use of drone technology and self-driven vehicles are expected to be leveraged by first movers in the industry to meet the expectations of customers (Chen, Gillai, Lee, and Rammohan, 2016: 2). Amazon's Drone technology provides high speed delivery over various terrain due to its not being constrained by road traffic. However, it is also accompanied by capacity constraints, inaccurate global-positioning system (GPS) data and safety risks. Drone technology is currently being tested for commercial delivery by Matternet, Amazon and DHL for the acquisition of permits which could potentially be used in the last mile (Chen *et al.,* 2016: 11). Self-driven fully autonomous vehicle are also a potential differentiator that DHL is testing in the last mile which expected to be road worthy in the U.S by 2020 (Chen *et al.,* 2016: 18).

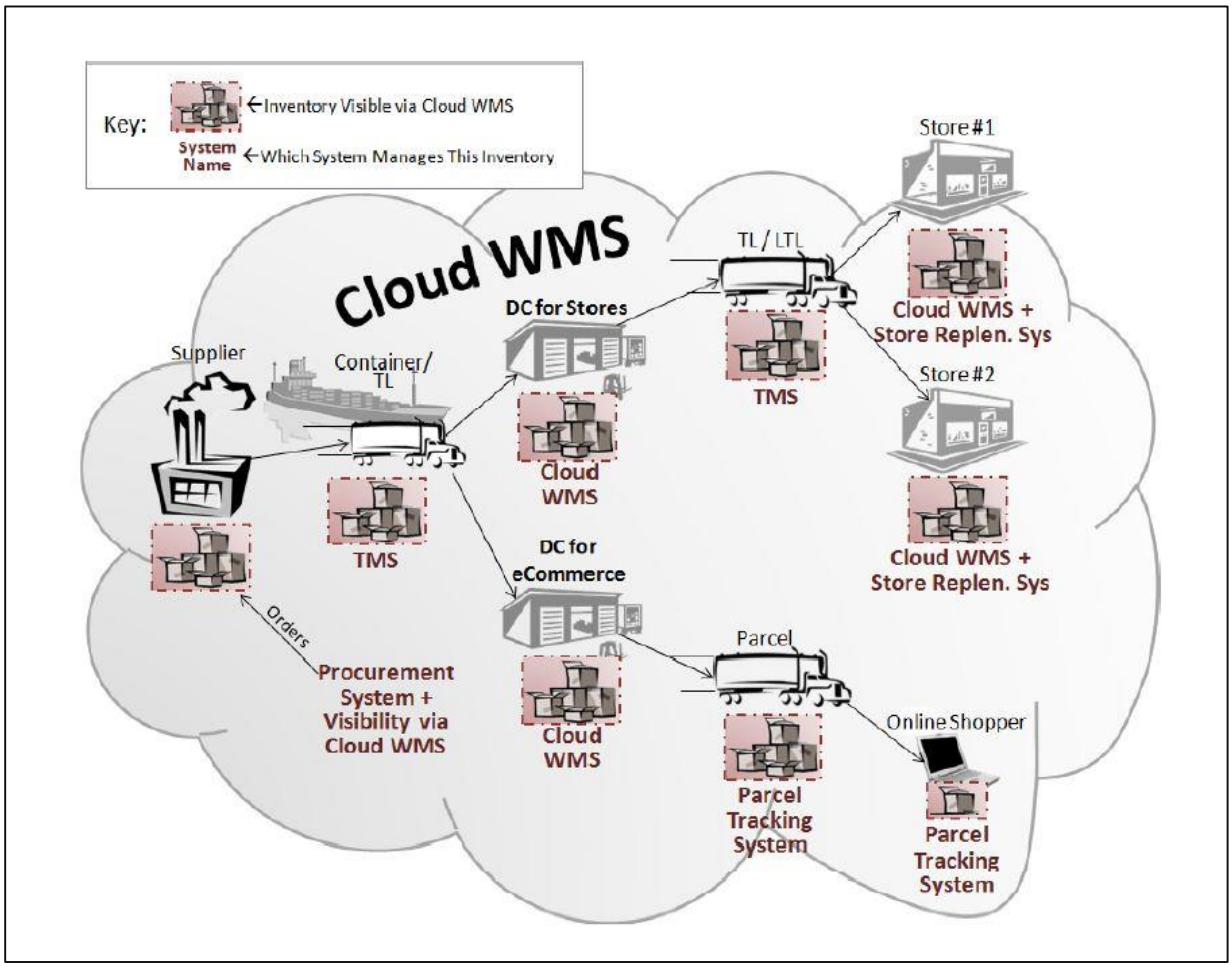
2.8.2 Information systems

Information in the virtual supply chain has been recognised by businesses as a key component for a successful supply chain (Nieman *et al.,* 2012:198). The Supply Chain Council uses a Supply Chain Operations Reference model (SCOR) to monitor best practice information system metrics such as customer satisfaction, lead time, logistics cost and asset utilisation (Nieman *et al.,* 2012:204). Ultimately the system is required to improve the quality of service and customer satisfaction by reducing lead time and costs through information visibility and reduced administrative work.

2.8.2.1 E-commerce and cloud computing

Cloud based technology and integrated inventory management systems are being used to create a unified database as depicted in figure 2.14 (Mcbeath, 2012:5) and The Park Avery Group (2015:4).

Figure 2.14: Cloud based visibility across inventory systems



Source: McBeathe, Omni Retailing Markets Association (IORMA). (2014) *Africa…In an Omni World*. [Online]. Available: http://www.iorma.com/reports/uk-retail-market-opportunity-report-may-2014 [1 May 2014]

According to Aydin (2015:27) e-commerce companies are reaping the benefits of cloud computing. The author (2015:27) defines e-commerce as a process of exchanging products and services between customer and organisation through the internet.

Aydin (2015:27) also defines cloud computing as "A dynamic computing environment which allows scalability and provides virtualized resources as a service through the Internet". The author adds that the use of e-commerce though cloud computing allows businesses to rent hardware and software rather than buying it. RIS (2015:3) supports Aydin (2015:27) that hardware costs are reduced whilst minimal integration and maintenance is required. According to RIS (2015:3), a cloud based omni-channel provides seamless, real time visibility of data and offerings across all channels and provides businesses with the capability of responding to demand faster through information visibility and processing agility. Owing to concerns regarding information security, Aydin (2015:29) states that the companies need to ensure that service providers abide by security standards and best practices to ensure information is protected across all channels. Using cloud based technology and integrating WMS/DMS/TMS with the order management system, network inventory is linked to demand.

2.9 Conclusion

The emergence of omni-channel retailing necessitates a change in distribution systems in order to achieve perfect order fulfilment. Through the implementation of order management and cloud computing, the supply chain has end to visibility of network inventory. The push-pull theory supports the adoption of the JIT system in a decoupled supply chain to overcome demand uncertainty and lead time variability through leagility. Network inventory and omni-channel demand can therefore be co-ordinated at the distribution centre and in the last mile to achieve perfect order fulfilment.

CHAPTER THREE

A CASE STUDY OF RETAILER X

Case studies are used to collect information about an activity in a firm or industry (Hair *et al.*, 2007:203). The purpose of conducting a case study is to establish a complete picture of the entire situation through the examination of a real life example (Hair *et al.*, 2007:203). Retailer X is being used as a case study to gain a vast amount of information in line with the research questions from a South African stand point. Raw data of online order history is analysed to assess the extent that online deliveries achieve perfect order fulfilment.

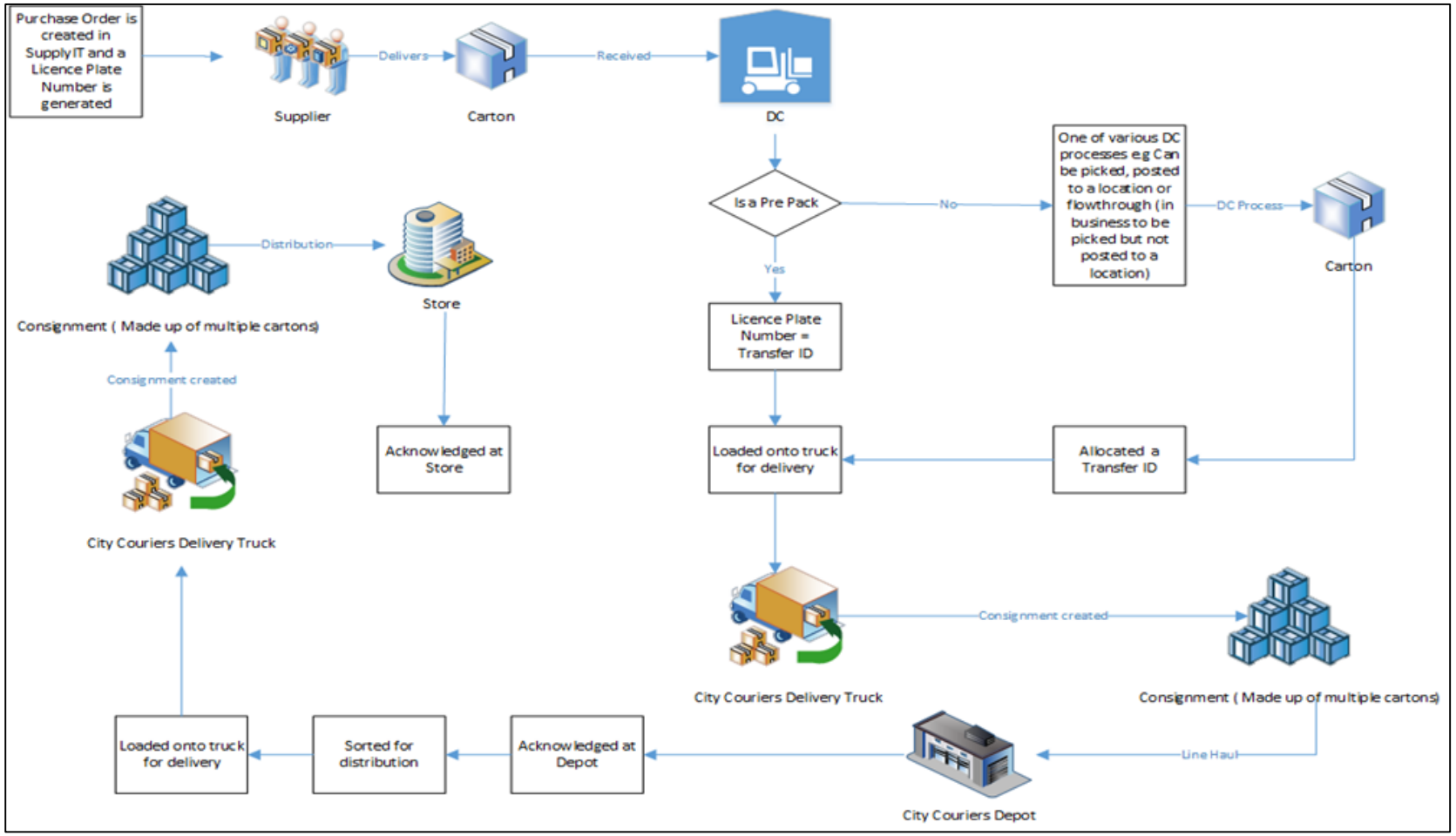
3. Introduction

Retailer X's goal is to achieve fast fashion, quick response, high stock turnover and to maximize their sales potential in Southern Africa, Africa and the global arena, by offering outstanding differentiated fashion value with an improved quality to customers (Retailer X, 2012). They intend to optimize costs and processes, improve speed and accuracy of information and provide visibility throughout a flexible supply chain to enable their expansion plans (Retailer X, 2012). As part of their evolution from traditional retailing to omni-channel retailing, they extended to an e-commerce platform. Consumers are therefore able to shop in the brick and mortar, pop up stores and online using their website or mobile application. To accommodate for the extension in purchase channels, they had to adapt their distribution network in order to satisfy demand.

3.1 Distribution network

The distribution network for Retailer X comprises a main distribution centre which distributes to a host of regional depots. The distribution centre serves as a centralized storage and distribution facility whilst the regional facilities are used to sort and process stock to regional stores as illustrated in figure 3.1. Whilst the traditional network is the cornerstone of the distribution operation, order fulfilment of online and customer orders is facilitated through store to store fulfilment. Stock is distributed to the online and fulfilment store via the traditional distribution network as if stock is being delivered to a trading store. Whilst some stock is stored, the remaining stock is sorted for customers' orders based on demand via item to pick. Once the order is complete and is ready for delivery, it is picked up by a courier company and delivered to the trading stores. Alternatively, stock may be delivered by the courier from online and fulfilment store to the customers nominated point of delivery.

Figure 3.1: Distribution network



Source: (Retailer X, 2016)

3.2 Extension to e-commerce platform

Retailer X extended to an e-commerce platform in 2012 which was only available to South African shoppers. In 2013, they made their online network global by expanding their reach to 10 countries, whilst during 2014 - 2015, they expanded their global online network to 25 countries as depicted in table 3.1. The Apparel division reported 18.9% retail sales growth and 203.5% e-commerce sales growth in 2014 and 18.0% retail sales growth and 51.0% e-commerce sales growth in 2015 in the annual financial statements (Retailer X, 2014:36) and (Retailer X, 2015:35).

Table 3.1: Global online network

Global Network	2012	2013	2014	2015
South Africa	1	1	1	1
Other countries	0	9	24	24
Total	**1**	**10**	**25**	**25**

Source: (Retailer X, 2016. Data extract, Data report)

South Africa comprises 90.7% of online orders processed whilst United States and Nigeria are 3.2% and 2.9% respectively. Although the majority of the orders are from South African shoppers, the data indicates that their global outreach is growing.

Table 3.2: Orders processed

Orders submitted/processed	2012	2013	2014	2015	Grand Total	As %	2014 vs 2015
South Africa	31,729	94,917	148,760	167,628	443,034	90.7%	12.7%
United States and Global	2	2,120	7,536	5,979	15,637	3.2%	(20.7%)
Nigeria			7,976	6,107	14,083	2.9%	(23.4%)
Australia		2,104	5,467	2,184	9,755	2.0%	(60.1%)
New Zealand		1,227	1,386	500	3,113	0.6%	(63.9%)
Zimbabwe		211	519	1,639	2,369	0.5%	215.8%
Other countries	-	-	189	75	264	0.1%	(60.3%)
Total	**31,731**	**100,579**	**171,833**	**184,112**	**488,255**	**100.0%**	**7.1%**

Source: (Retailer X, 2016. Data extract, Data report)

3.2.1 Order fulfilment process

Local and international orders are fulfilled from the online store or fulfilment store based on fulfilment logic. For local orders, once the order has been placed by the customer, the customer's location data is submitted within the system. It is validated to establish whether it is authentic. If it is not authentic, then the GeoIP address is used. If it cannot be established then the order is fulfilled from the online store.

If the GeoIP address or captured address is valid, the closest fulfilment store is identified by the system and requirements are calculated. If the store has sufficient stock to fulfil the order then the order is submitted to the store. If the store does not have enough stock, then the order is submitted to the online store. The online store prioritises international orders over local orders and follows the FIFO rule for local orders. Stock is received, put away and moved into an 'available for sale' status. Once the order has been placed, the online store picks and packs the orders based on the prioritisation rule and FIFO. Store express and store economy utilize designated courier companies. However, international orders are delivered by a host of courier companies. The transport management system is programmed to select a courier from a pool of preselected couriers based on predetermined conditions. The system nominates a courier company based on the lead time and cost associated to each courier company. The most suitable courier is selected to deliver the order. The orders are moved into ready to ship status once the order has been packed and is collected by the nominated courier company. If the order cannot be fulfilled, the customer is refunded or the customer can opt for another colour of the item if available. The order is then fast tracked through the fulfilment process.

The fulfilment store functions a little differently in comparison to the online store and only fulfils local orders. It receives the orders on the point of sale application. The picking and packing of orders are prioritized based on the delivery method in the fulfilment store. Furthermore, the timing of order collection differs depending on the delivery methods. Express and door to door orders are collected from the store in the morning whilst economy orders are collected in the afternoon. Once the order has been picked and packed, the courier is informed that the order is 'ready for pick up' if the delivery method is door to door. Once the courier has picked up the order, the customer is informed that the order has been shipped. If the delivery method is store pickup, and the order has been picked and packed, it will have a 'ready to ship' status. Once the courier picks up the order, it will move into 'shipped' status. The customer will be informed that the order is in shipped status and will thereafter be informed that the order is ready for pick up once the order has been transferred into the destination store. The order moves to delivered status once it has been delivered to the customers nominated delivery address or once it has been picked up from the store.

3.2.2 Distribution methods

Retailer X offers four shipping methods to South Africans; door to door, store economy, store express and post office as illustrated in table 3.3 (Retailer X, 2016).

Table 3.3: Delivery methods offered

Delivery method	Lead time	Delivery cost
Store Economy	5-7 working days	R 5
Store Express	1-3 working days	R 35
Express (Door to Door)	1-3 working days	R 45
Post Office	Up to 7 working days	R 35

Source: (Retailer X website, 2016)

Orders delivered in 2014 and 2015 were analysed as the data identifying the delivery method was not substantial for orders placed in 2012 and 2013. Door to door deliveries which comprised 52.4% of orders, depicted in table 3.4, was the most utilized shipping method. Orders shipped via door to door are fulfilled out of the online store or fulfilment store and are delivered to the customers preferred address within 1-3 working days, at a rate of R45 in South Africa. This type of shipment follows the fully extended strategy if the order is picked from the fulfilment store and collected by the customer or centralized extended if the order is picked at the online store and is delivered to the customer as depicted in figure 1.4 of the Order fulfilment/delivery matrix (Boyer *et al.*, 2005:20).

Table 3.4: Delivery methods used in South Africa

Delivery method	2014	2015	As %	2014 vs 2015	2014 vs 2015 as a %
Door to Door	71,247	90,519	54.0%	19,272	27.0%
Store Economy	32,973	48,413	27.2%	15,440	46.8%
Store Express	33,006	20,379	17.8%	(12,627)	(38.3%)
Post Office	2,694	205	1.0%	(2,489)	(92.4%)
Grand Total	**139,920**	**159,516**	**100.0%**	**19,596**	**14.0%**

Source: (Retailer X, 2016. Data extract, Data report)

Orders shipped via store economy and store express comprise 27.2% and 17.8% of total orders respectively. Using these shipment methods, orders are fulfilled out of the fulfilment store and are delivered to a trading store of the customer's choice. However, the two shipping methods differ in rate and lead time. Whilst store economy has a lead time of 5-7 working days at rate of R5, store express has a lead time of 1-3 working days at a rate of R35.

The shipment methods appear to follow the semi-extended strategy and decoupled strategy since orders are picked at the online store and fulfilment store but can only be collected by customers from the fulfilment store (Boyer *et al.*, 2005:20). Stock picked at the online store is redistribution to fulfilment stores situated near the delivery destination. Delivery via post office is also used as a shipping method in South Africa. Stock is delivered from the online store to the customer's nominated postal address via the South African postal service. Delivery via post office costs R35 and takes up to 7 working days for the order to be delivered (Retailer X, 2016). This method appears to be scarcely used in comparison to door to door and store deliveries as it made up 1.0% of orders. It is presumed that the high shipping cost and long lead time is deterring customers in addition to the bad publicity that the postal service received (PWC, 2012:21). Delivery via postal service appears to the centralized extended strategy since orders are picked at the online store and delivered to customers via post (Boyer *et al.*, 2005:20). In 2014, 148 760 orders placed by South African shopper were processed and 139 920 orders were delivered. In 2015, 167 628 orders were processed and 159 516 orders were delivered. The difference in orders processed and delivered decreased from 8840 orders to 8112 orders. The gap is possibly attributable to orders being cancelled prior to delivery or not being delivered. It is noted that whilst the gap has been reduced, the variance is still significant as the customer would have to be refunded resulting in a lost sale. Shipment via door to door and store economy showed the most significant year on year growth of 54.0% and 27.2% which represents an extra 19 272 and 15 440 orders from each shipment method. The customer base for local orders appears to comprise a mix of either cost conscious and convenience focused customers. Whilst some South African shoppers appear to favour a lower cost and longer lead time option reflected by the high growth in store economy, others favour high cost and quick delivery via the door to door delivery option.

Economy and express are options offered to international customers whilst store delivery is an additional option for countries that have a brick and mortar presence (Retailer X, 2016). The maximum lead days for order processing and delivery via express and economy is 5 and 14 days respectively. Orders delivered via economy are shipped to the customers postal address using the postal service whilst, express functions like door to door deliveries where orders are shipped directly to the customer's nominated address. Economy appears to be the most popular delivery method abroad due to it comprising 92.7% of orders delivered internationally whilst the use of express and store express is minimal at 7.2% and 0.05% as illustrated in table 3.5.

Table 3.5: Delivery methods used in other countries

Shipping method	2014	2015	As %	2014 vs 2015	2014 vs 2015 as a %
Economy	11,374	5,595	92.7%	(5,779)	(50.8%)
Express	608	719	7.2%	111	18.3%
Store Express		9	0.05%	9	100.0%
Grand Total	**11,982**	**6,323**	**100.0%**	**(5,659)**	(47.2%)

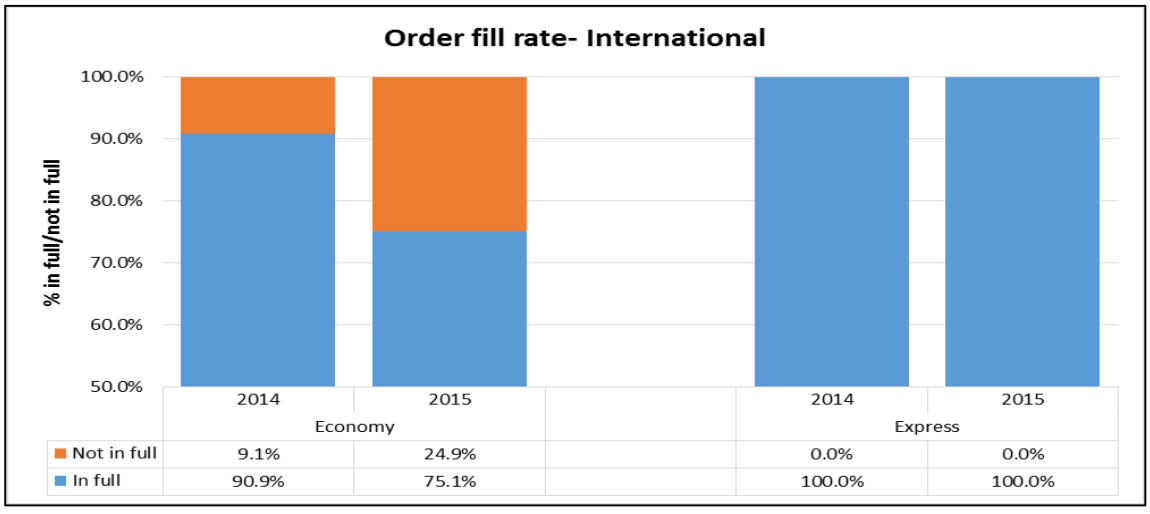
Source: (Retailer X, 2016. Data extract, Data report)

Orders delivered via economy showed a significant decrease of 5779 orders whilst delivery via express showed a marginal increase of 111 orders and a minimal amount of orders delivered via store economy. Delivery via economy and express appears to be a combination of the decoupled and fully extended strategy as in the case of postal and door to door delivery methods used in South Africa (Boyer *et al.*, 2005:20). Order processed deceased by 7200 seen in table 3.1, whilst orders delivered decreased by 5659, as seen in table 3.5. The results indicate that orders processed for international customers decreased followed by a further decrease in the orders delivered which implies that some orders were also cancelled prior to delivery.

3.2.3 E-commerce service level agreement with customers

The service level agreement with customers is dependent on the delivery method chosen. Orders are expected to always be delivered in full, in good condition and within the delivery times. The fill rate for orders delivered to South African customers was calculated as the percentage of orders partially delivered and not delivered as a percentage of orders processed in 2014 and 2015. The fill rate was 100% for all delivery methods in 2014 and 2015.

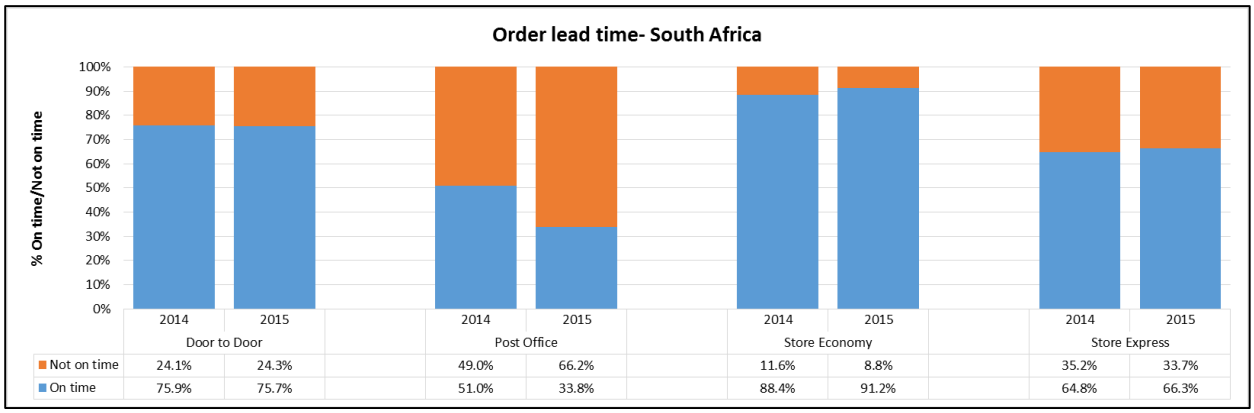
Figure 3.2: Order fill rate- International



Source: (Retailer X, 2016. Data extract, Data report)

Figure 3.2 illustrates the order fill rate for orders delivered to international customers. The fill rate was calculated as the percentage of orders partially delivered and not delivered as a percentage of orders processed in 2014 and 2015. The fill rate declined by 15.8% for deliveries via economy whilst deliveries via express have a fill rate of 100%. Overall, the fill rate was above 75% in 2014 and 2015 for both delivery methods.

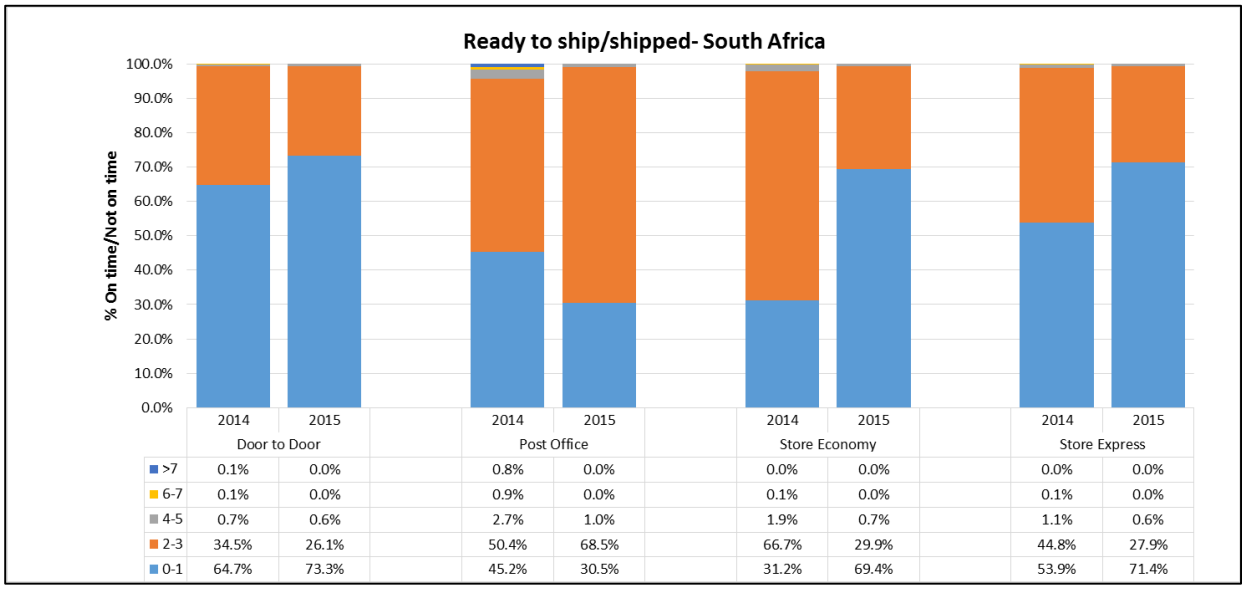
Figure 3.3: Order lead time- South Africa



Source: (Retailer X, 2016. Data extract, Data report)

Figure 3.3 depicts a comparison of the order lead time of each delivery method in South Africa in 2014 and 2015. The variance between the submit date or processing date and ready for store pick up date or delivered date was compared against the latest expected delivery date depicted in figure 3.4. The calculation took into account weekend and public holidays as deliveries are only made on weekdays. 75.9% and 75.7% of orders delivered via door to door were delivered on time in 2014 and 2015 respectively, whilst 24.1% and 24.3% were late in each of the years. Deliveries via store economy shows an improvement as there was an increase of on time deliveries to 91.2%, whilst 8.8% were delivered late. Store express increased to 66.3% in 2015 whilst 33.7% of orders were not on time. On time deliveries via the Postal System decline by 17.2% to 33.8% whilst 66.2% of orders were not delivered on time. Store economy appears to satisfy the service level agreement with the customer the most as majority of orders delivered via this method were on time. Delivery via door to door, store express and post were late for at least 24% of orders for each delivery type which indicates that lead time needs attention for these delivery methods. Deliveries via the postal service appear to be the most problematic as 66.2% of the orders were not delivered on time.

Figure 3.4: Order processing time- South Africa



	2014	2015	2014	2015	2014	2015	2014	2015
	Door to Door		Post Office		Store Economy		Store Express	
>7	0.1%	0.0%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
6-7	0.1%	0.0%	0.9%	0.0%	0.1%	0.0%	0.1%	0.0%
4-5	0.7%	0.6%	2.7%	1.0%	1.9%	0.7%	1.1%	0.6%
2-3	34.5%	26.1%	50.4%	68.5%	66.7%	29.9%	44.8%	27.9%
0-1	64.7%	73.3%	45.2%	30.5%	31.2%	69.4%	53.9%	71.4%

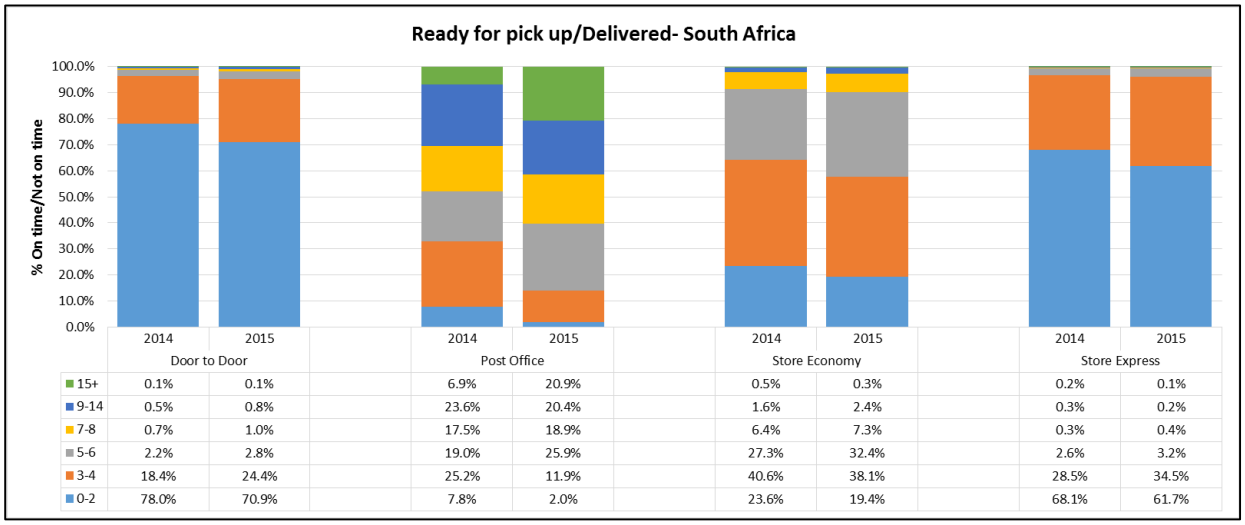
Source: (Retailer X, 2016. Data extract, Data report)

The myriad steps in the order fulfilment process necessitates analysis into the order processing time and delivery time to isolate the cause of the later deliveries. The order processing time for orders placed by South African shoppers was established by analysing the difference in the submitted or processing status and ready to ship or shipped status. The processing time indicates how long it takes to pick the order and have it ready for pick up by the courier. The processing time was grouped into 0-1 day, 2-3 days, 4-5 days, 5-6 days and greater than 7 days. Seven days were used as it is the maximum lead days from the time when the order was submitted up to the point of delivery amongst the delivery methods. Figure 2.4 illustrates the service level agreement with the customer.

Door to door deliveries have a lead time of 1-3 working days. Door to door deliveries showed an improvement in the order processing time. 73.3% of orders were processed within 1 day in 2015 compared to 64.7% in 2014. 26.7% of order were processed within 2-3 days or more. There is an improvement in the processing of orders for door to door shipment from 2 days to 1 day which is within the service level agreement of 1-3 days. 69.4% of orders delivered via store economy were processed within 1 day in 2015 compared to 31.2% in 2014. Orders processed within the 2-3 day group therefore decreased from 66.7% to 29.9%. Fewer orders were processed within 4 or more days, there is a reduction from 2.0% to 0.7%. Orders delivered via store express also showed an improvement in the processing time. 71.4% of orders were processed within 1 day in 2015 compared to 53.9% in 2014.

Orders processed within the 2-3 day group therefore decreased from 44.8% to 27.9%. Fewer orders were processed within 4 or more days, there is a reduction from 1.2% to 0.6%. Order processing for store express orders satisfies the service level agreement of 1-3 days. Order processing time of orders delivered via store economy reduced to within 1 day. Delivery via post office showed that more orders were late in 2015 compared to 2014. Orders processed within the first day reduced from 40.2% to 30.5% with a higher percentage of orders being processed in the 2-3 day time frame, from 68.5% to 50.4%. Order processed within 4 days or more declined from 4.4% to 1.0%. The data indicates that orders are being processed faster year on year and the majority of the orders are processed within 1 day across all delivery methods except post for orders placed by South African shoppers. The delivery time needs to therefore be analysed to assess the lead time between when the order is ready to ship or shipped status and ready for pick up and delivered status. The analysis will assess the duration taken between when the order is ready to be picked up the courier and when the order is delivered to the store for in-store pick up or when the order is delivered to the customers designated place of delivery. Lead time was grouped into 0-2 days, 3-4 days, 5-6 days, 7-8 days, 9-14 days and 15 days and greater. The grouping indicate the duration between pickup from the online and fulfilment store and delivery to the trading store or the customer's nominated place of delivery.

Figure 3.5: Delivery time- South Africa



	2014	2015	2014	2015	2014	2015	2014	2015
	Door to Door		Post Office		Store Economy		Store Express	
15+	0.1%	0.1%	6.9%	20.9%	0.5%	0.3%	0.2%	0.1%
9-14	0.5%	0.8%	23.6%	20.4%	1.6%	2.4%	0.3%	0.2%
7-8	0.7%	1.0%	17.5%	18.9%	6.4%	7.3%	0.3%	0.4%
5-6	2.2%	2.8%	19.0%	25.9%	27.3%	32.4%	2.6%	3.2%
3-4	18.4%	24.4%	25.2%	11.9%	40.6%	38.1%	28.5%	34.5%
0-2	78.0%	70.9%	7.8%	2.0%	23.6%	19.4%	68.1%	61.7%

Source: (Retailer X, 2016. Data extract, Data report)

Door to door orders delivered by courier in the 0-2 day delivery time frame declined by 7.1% year on year. The order processing time show indicates that the majority of door to door orders were processed within 1 day as illustrated in figure 3.4.

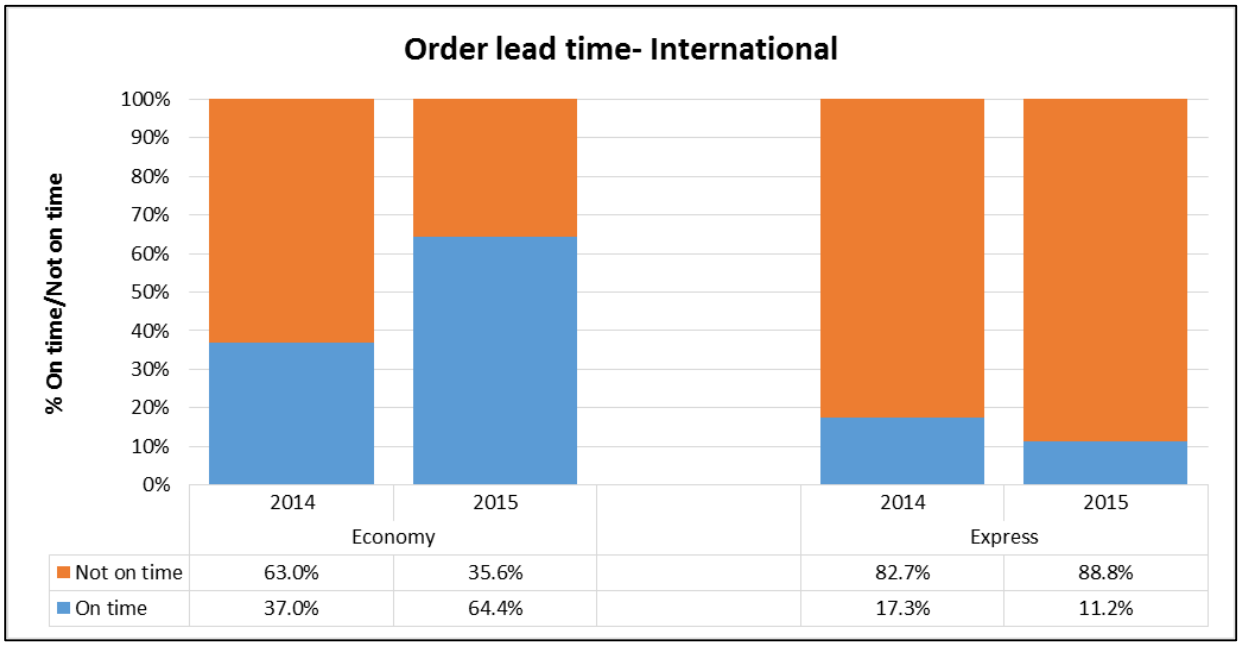
This implies that the courier has 2 working days to pick up and deliver the order to the customer. Figure 3.5 illustrates orders delivered within 0-2 days decreased by 7.1% upon comparing 2014 and 2015.
There appears to be an increase by 6.0% of orders in the 3-4 day grouping between both years. Whilst 70.9% orders were collected and delivered by couriers within 0-2 days, 24.4% of orders took 3-4 working days to be collected and delivered in 2015. There has also been an increase in the percentage of orders delivered between 5 or more day. Whilst 2.2% of the orders were delivered within 5 or more days in 2014, 2.8% of the orders were delivered within 5 or more days in 2015. The delivery of the orders via door to door appears to have taken longer in 2015 compared to 2014.

Orders processed for store express showed an improvement when comparing 2014 and 2015 in figure 3.4. However, there were orders that were not delivered within the 1-3 day lead time. The order processing time showed an improvement whereby orders were processed within 1 day. This implies that the courier has up to 2 working days to pick up and deliver the order to the customer. Figure 3.6 illustrates order delivered within 0-2 days decreased by 6.4% and orders delivered within 3-4 days increased by 6.0% when comparing 2014 and 2015. There appears to be an increase of 0.6% of orders in the 5-6 day group and orders in groups greater than 7 days increased by 0.2% year on year. Whilst 61.7% of orders were picked up and delivered by couriers within 0-2 days, 34.5% of orders took 3-4 days, 3.2% took 5-6 days to be picked up and 0.7% took 7 or more days to be delivered in 2015. 38.3% of orders took greater than 2 days to be delivered. As a result a large percentage of these orders were late. Delivery time needs to be improved to ensure orders are delivered on time.

Orders delivered via store economy showed an improvement when comparing the percentage of orders delivered on time in 2014 and 2015 in figure 3.3. However, there were orders that were not delivered within the 5-7 day lead time. The order processing time showed an improvement whereby orders were processed within 1 day. This implies that the courier has up to 6 working days to pick up and deliver the order to the customer. Figure 3.5 illustrates order delivered within 0-2 days and 3-4 days decreased by 4.2% and 2.5% respectively when comparing 2014 and 2015. There appears to be an increase of 5.1% and 2.0% of orders in the 5-6 and 7-15 day grouping between both years. Whilst 19.4% of orders were picked up and delivered by couriers within 0-2 days, 38.1% of orders took 3-4 days, 32.4% took 5-6 days and to be picked up and 2.0 % took 7 or more days to be delivered in 2015. 2% of orders took 7 or more days to be delivered in 2015 which indicates that most of store economy deliveries are within SLA.

Orders delivered via post worsened when comparing the percentage of orders delivered on time in 2014 and 2015 in figure 3.5. The order processing time for orders in the 1 day grouping worsened year on year. This implies that the courier has up to 6 working days to pick up and deliver the order to the customer for orders processed in the 1 day grouping and 4-5 days for orders in the 2-3 day group. Figure 3.5 illustrates that 7.8% of orders delivered within 0-2 day group in 2014 and 0.2% in 2015. 25.2% of orders were delivered 3-4 day group in 2014 and 11.9% in 2015. Although there were 19.0% and 25.9% of orders delivered in 5-6 day group in 2014 and 2015 respectively, 60.2% of orders were delivered within 7 days or more in 2015 compared to 48.0% in 2014. Delivery via post appears to not be in line with the 7 day service level agreement as the majority of the orders took more than 7 days to be processed and delivered.

Figure 3.6: Order lead time- International

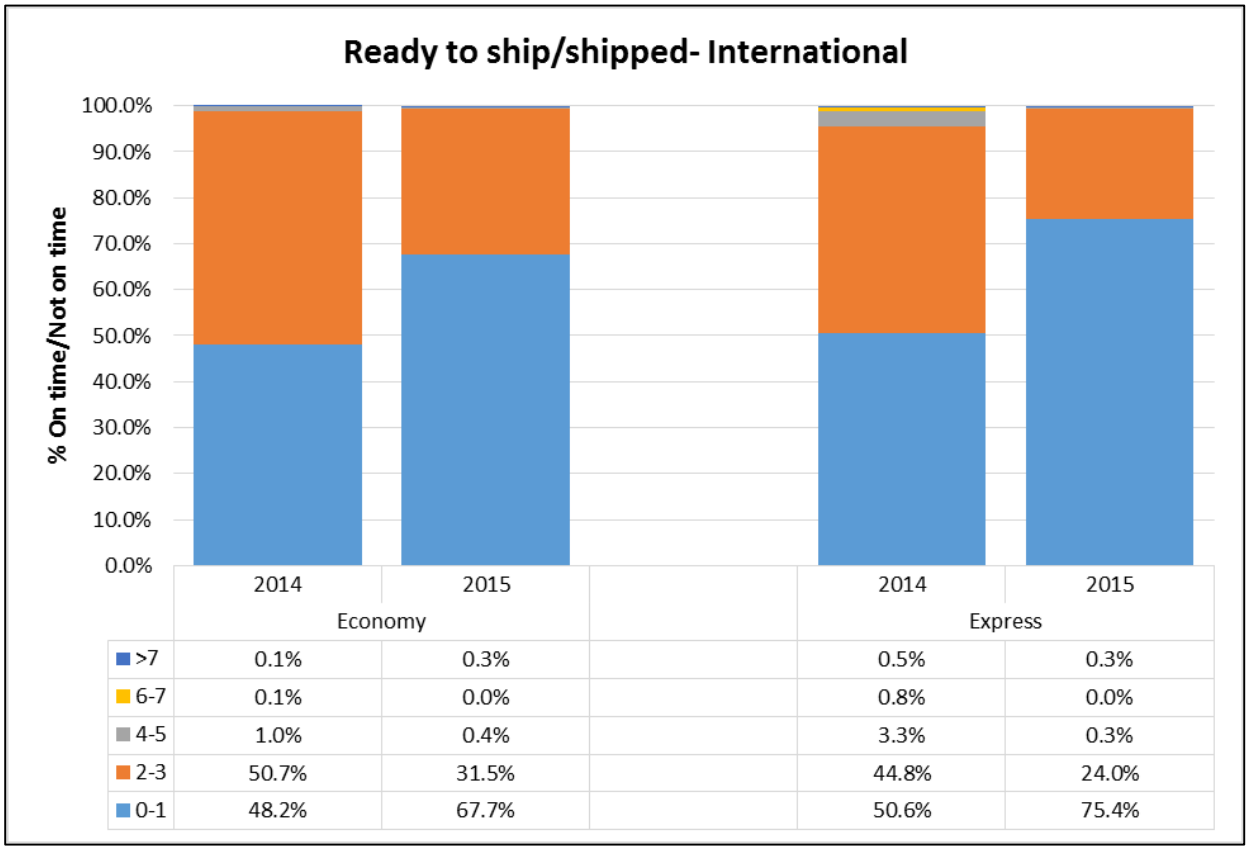


Source: (Retailer X, 2016. Data extract, Data report)

Figure 3.6 illustrates a comparison of the order lead time of international orders delivered via economy and express in 2014 and 2015. The variance between the submit date or processing date and ready for store pick up date or delivered date was compared against the latest expected delivery date of 14 days from the date the order was submitted. Saturday and Sunday was removed from the calculation of lead time as the majority of the countries have a Monday to Friday working week.

The graph indicate that deliveries via economy improved by 27.4% to 64.4% in 2015 whilst 35.5% of the deliveries were late. However, deliveries via express shows a decline in service delivery as there was a decrease in the on time rate by 6.1% to 11.2%. The results indicate that whilst majority of the orders delivered via economy are on time, deliveries via express are almost always late. This indicates that lead time of international orders needs to be improved.

Figure 3.7: Order processing time- International



	Economy 2014	Economy 2015	Express 2014	Express 2015
>7	0.1%	0.3%	0.5%	0.3%
6-7	0.1%	0.0%	0.8%	0.0%
4-5	1.0%	0.4%	3.3%	0.3%
2-3	50.7%	31.5%	44.8%	24.0%
0-1	48.2%	67.7%	50.6%	75.4%

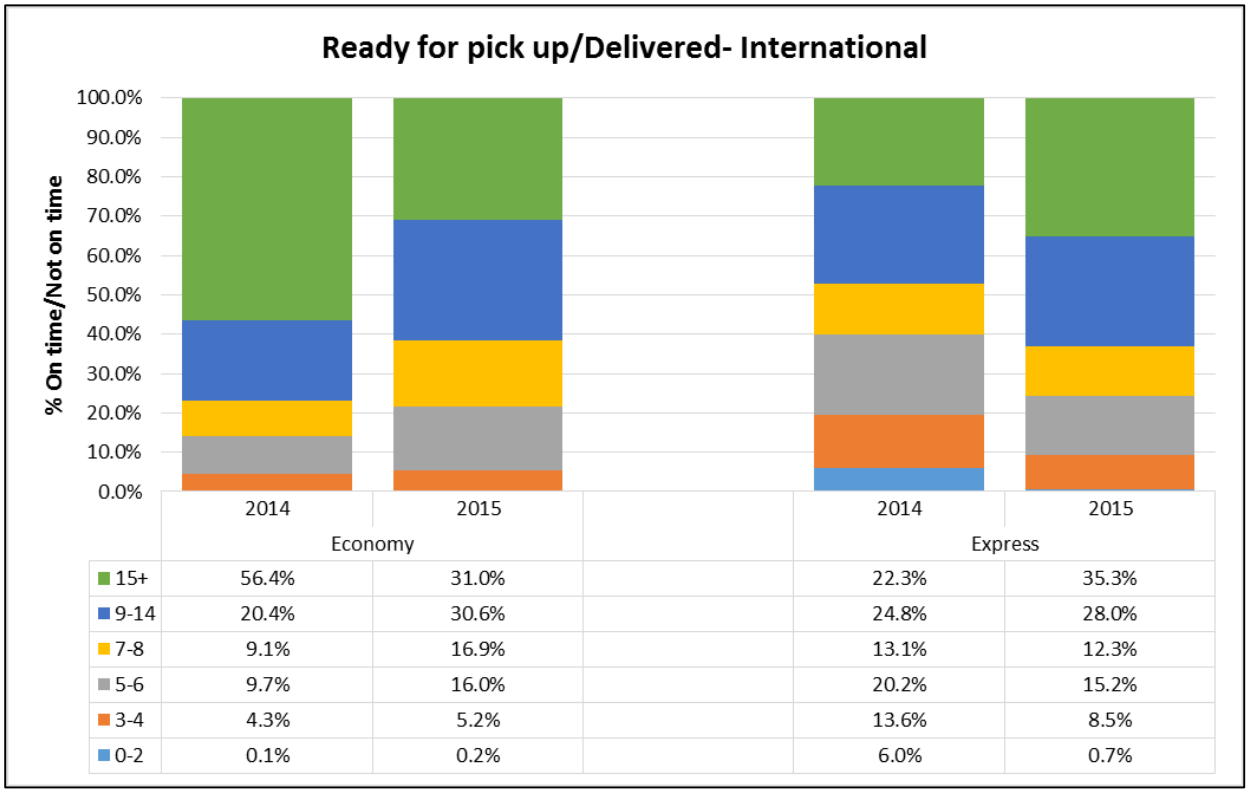
Source: (Retailer X, 2016. Data extract, Data report)

The order processing time for orders placed by international customers was established by analysing the difference in time of submitted or processing status and ready to ship or shipped status. The processing time indicates how long it takes to pick the order and have it ready for pick up by the courier. The processing time was grouped into 0-1 day, 2-3 days, 4-5 days, 5-6 days and greater than 7 days. 67.6% of orders shipped via economy were processed within 1 day in 2015 compared to 48.2% in 2014. 50.7% and 31.5%of orders were processed within 2-3 days in 2014 and 2015 respectively. Less than 1.0% of orders were processed longer than 3 days in 2014 and 2015. Orders shipped via expresses also showed an improvement in the processing time.

Approximately 75.4% of orders were processed within 1 day in 2015 compared to 50.6% in 2014. 44.8 % and 24.0% of orders were processed within 2-3 days in 2014 and 2015 respectively whilst 4.6% of orders took more than 3 days to be processed in 2014 and 0.6% in 2015. Order processing time improved in 2015 for deliveries via economy and express. More than 67% of deliveries via both shipping methods were processed within 1 day.

The data indicates that orders placed by international customers are being processed faster across both methods. The delivery time needs to therefore be analysed to assess the lead time between when the order is ready to ship or shipped status and delivered status. The analysis will assess the duration taken between when the order is ready to be picked up the courier and when the order is delivered to the post office or customers designated place of delivery. Lead time was grouped into 0-2 days, 3-4 days, 5-6 days, 7-8 days, 8-15 days and greater than 15 days. The grouping indicate the duration between pickup from the online and fulfilment store and delivery to the customer's nominated place of delivery.

Figure 3.8: Delivery time- International



Source: (Retailer X, 2016. Data extract, Data report)

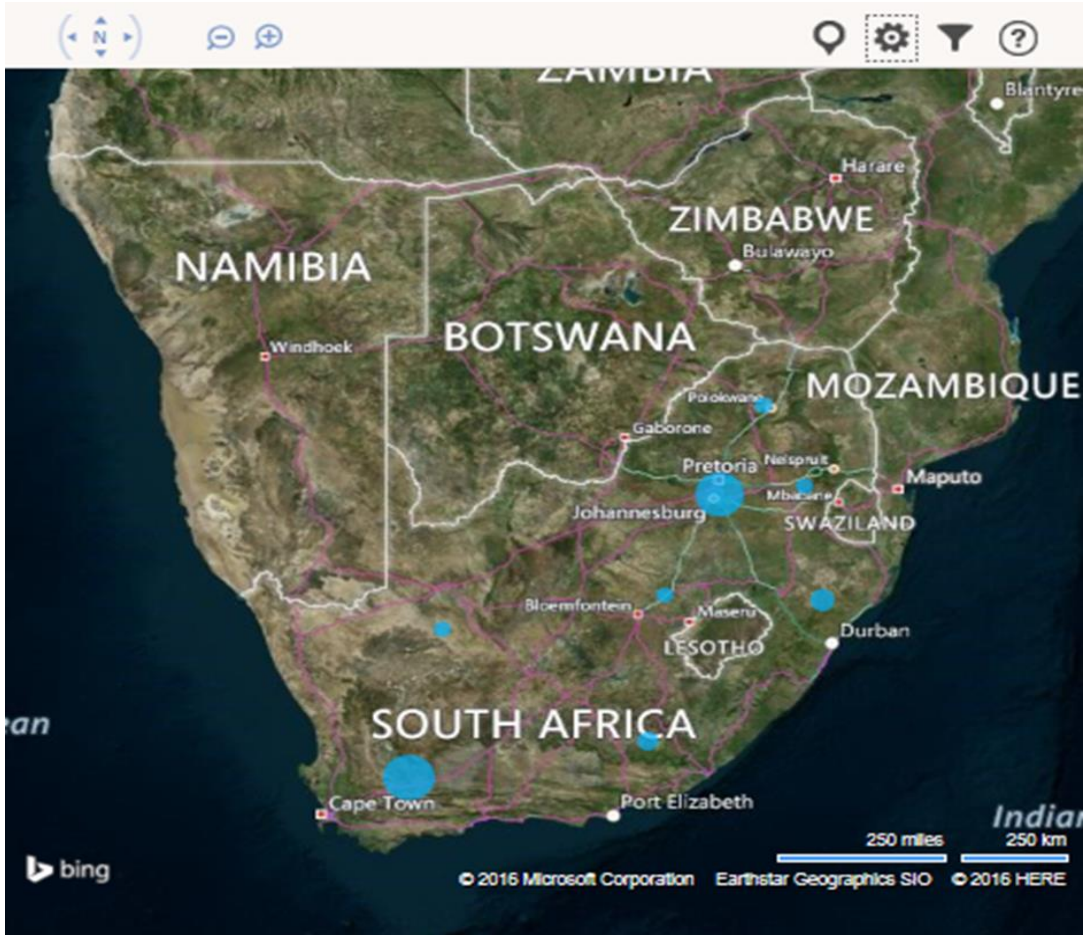
Orders delivered via economy showed an improvement in the percentage of on time deliveries when comparing 2014 and 2015 in figure 3.7. However, there were orders that were delivered after the maximum lead time of 15 days for deliveries via economy. The order processing time showed an improvement whereby 67.7% of orders were processed within 1 day. This implies that the courier services has 14 working days to pick up and deliver the order to the customer. Figure 3.8 illustrates that the percentage of orders couriered in 15 or more days decreased from 56.4% to 31.0%. Although there has been an improvement, the orders that we courier for longer than 14 days were late and represent a shortcoming in the process. Order which are not delivered on time appear to be delayed due to prolonged delivery times. Orders delivered via express showed a decline in the percentage of on time deliveries when comparing 2014 and 2015 in figure 3.6. There were orders that were delivered after the maximum lead time of 5 days. The order processing time showed an improvement whereby 75.4% of orders were processed within 1 day. This implies that the courier services has 4 working days to pick up and deliver the order to the customer. Approximately 9.2% of orders were delivered within 4 days whilst 90.8% of the orders were late. It is presumed that if orders were processed within 1 day and a courier collected the order and began arranging transportation of the order from the same day, the majority of the orders were still delivered late. Order which are not delivered on time appear to be delayed due to prolonged delivery times for deliveries via economy and express. Although the proportion of international orders are much smaller than the quantity of orders delivered in South Africa, the results imply that the supply chain is not fully abiding by the SLA.

All local deliveries except delivery via the postal service achieved a 100% fill rate in 2014 and 2015. Whilst there was an improvement in the lead time for door to door, store economy and store express, delivery via postal system reflected a reduction in the percentage of order on time by 14.7%. For orders delivered via economy, fill rate decreased by 8% but lead time increased by 15.8%. Orders shipped via express, fill rate remained at 100% in 2014 and 2015 on time deliveries decreased by 6.1%. 100% fill rate was achieved for order shipped via door to door, store economy, store express, post and express whilst the fill rate for deliveries via economy worsened. Order lead time has shown an improvement across all delivery methods for orders placed by South African and international shoppers except post and express. Almost 70% of orders which represents a majority was processed within 1 day. The lead time in transportation process appears to be taking longer than the lead time stipulated in the service level agreement which is deterring perfect order fulfilment.

3.2.4 The last mile

The last mile has an implicit impact on order fulfilment. The service agreement with the 3PL is dependent on the service model and distance between DC and customer. The transit time groupings for local and international orders are being used as per the prior section. In South Africa, Western Cape, Gauteng and Kwa-Zulu Natal constitute the top three provinces with the most online orders in South Africa in 2015 as seen in figure 3.9. It is noted that 100% fulfilment occurred from the online store in 2014 whilst 99% of fulfilment occurred from the online store in 2015 due to the inception of store fulfilment in 2015.

Figure 3.9: Geographical dispersion of online orders in South Africa



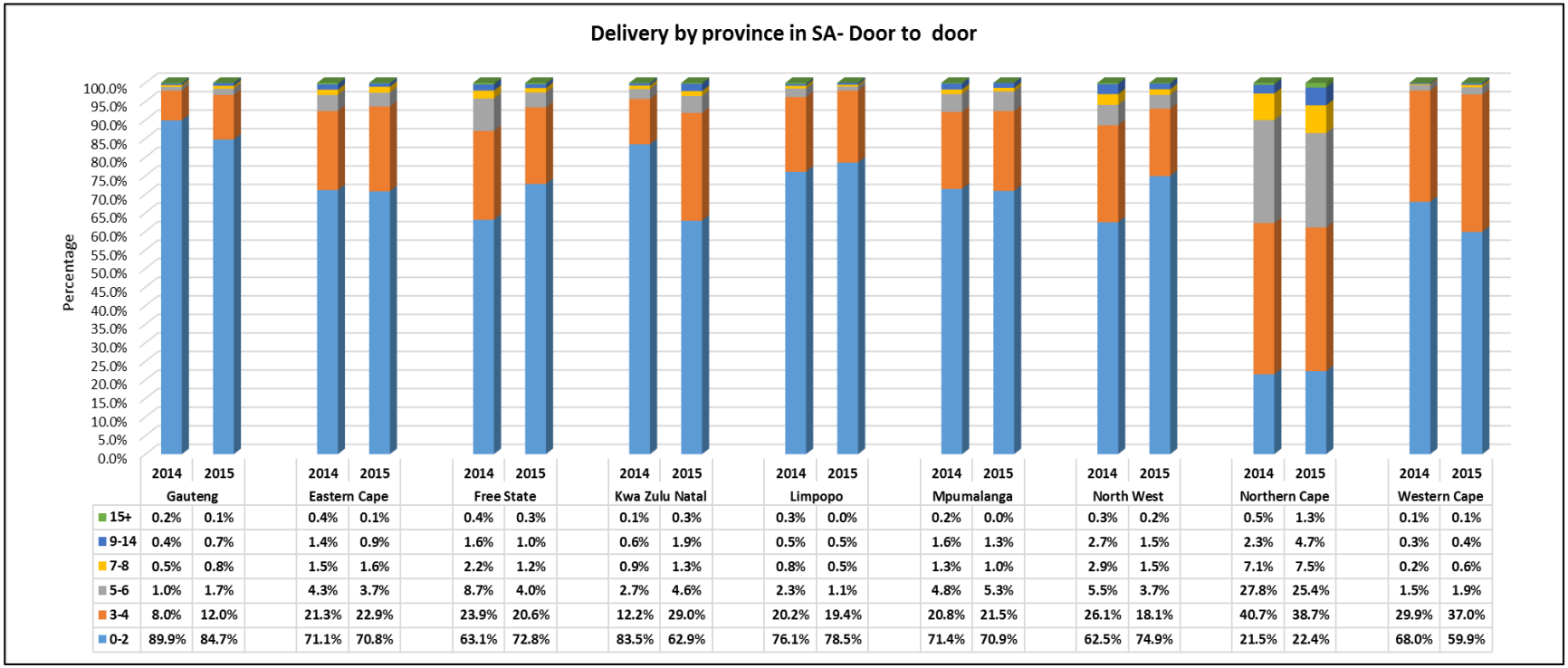
Gauteng	36%
Eastern Cape	6%
Free State	2%
Kwa Zulu Natal	11%
Limpopo	2%
Mpumalanga	3%
North West	1%
Northern Cape	2%
Western Cape	38%

Source: (Retailer X, 2016. Data extract, Data report)

The transit time for deliveries to Gauteng was the highest at 84.7% for 0-2 day transit time, followed by Limpopo which scored 78.5%. Northern Cape, Western Cape and Kwa-Zulu Natal achieved the lowest percentage for 0-2 day transit time of 22.4%, 59.9% and 62.9% respectively. 60.0%- 71.0% of orders for the remaining provinces scored in the 0-2 day transit time frame. These provinces also appear to require 1-2 days extra to deliver 90% of the orders. It is also noted that Gauteng, Western Cape and Kwa-Zulu Natal constitute the biggest percentage of total orders respectively and services levels need to be improved in these regions particularly. It also appears that regions closer to the online store in Gauteng had more orders fall in the 0-2 day time frame such as Gauteng and Limpopo compared to Western Cape, Kwa-Zulu Natal and Northern Cape. Order fulfilment from the fulfilment store began in the latter part of 2015 and 1% of orders were fulfilled from the fulfilment store. The result extracted is therefore mainly indicative of deliveries from the online store.

Deliveries via store express indicate that Gauteng, followed by North West province are achieving the most orders in the 0-2 day transit time frame at 86.6% and 81.9% respectively whilst Western Cape, Eastern and Northern Cape are shipping the least amount of orders in the 0-2 day transit time frame at 36.5%, 44.5% and 50.9% respectively as depicted in figure 3.10. The remaining provinces were shipped 66.0%- 77.0% of orders in the 0-2 day transit time frame. These provinces also appear to require 1-2 days extra to deliver 90% of the orders. The result is similar in comparison to door to door to deliveries as the lead time is the same for both shipping methods.

Figure 3.10: Geographical dispersion of door to door orders in South Africa

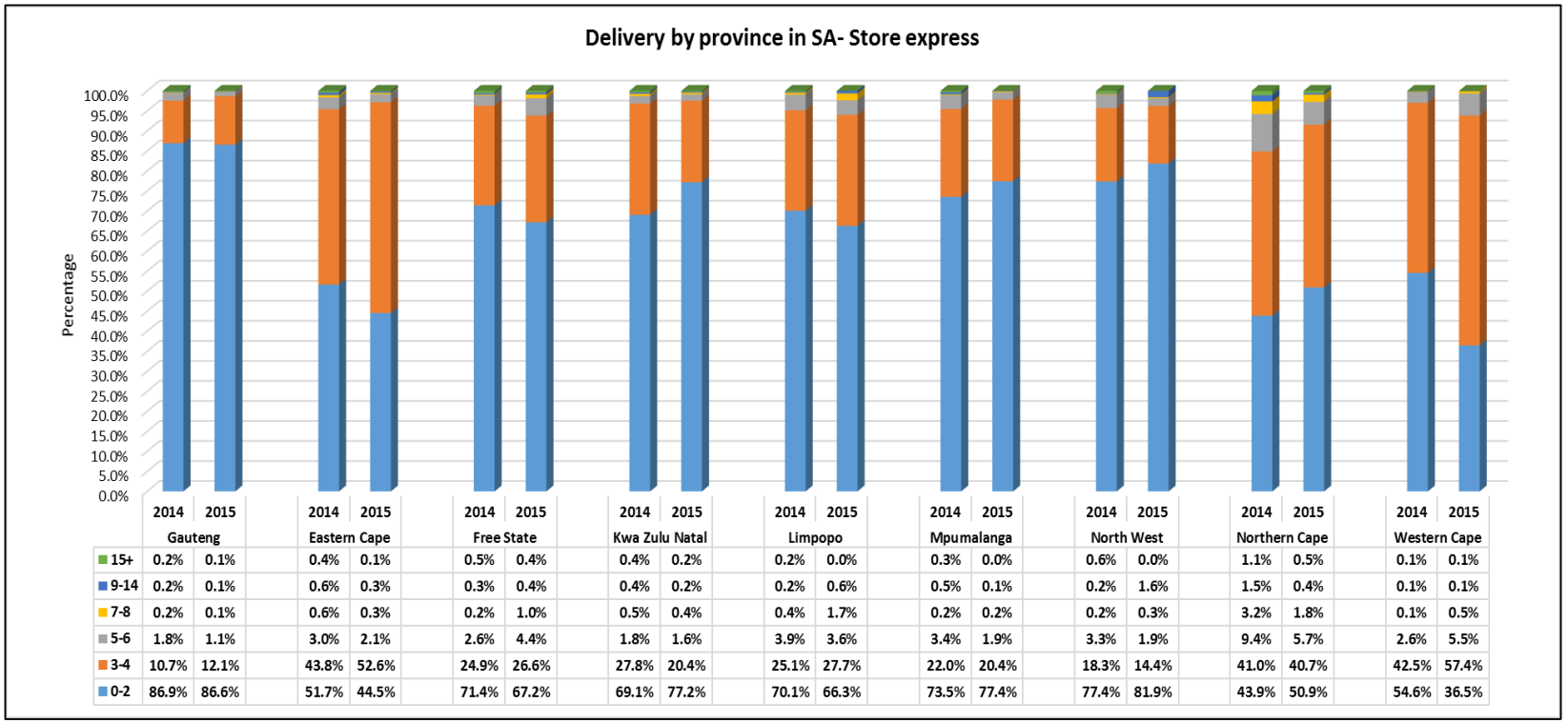


	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
	Gauteng		Eastern Cape		Free State		Kwa Zulu Natal		Limpopo		Mpumalanga		North West		Northern Cape		Western Cape	
15+	0.2%	0.1%	0.4%	0.1%	0.4%	0.3%	0.1%	0.3%	0.3%	0.0%	0.2%	0.0%	0.3%	0.2%	0.5%	1.3%	0.1%	0.1%
9-14	0.4%	0.7%	1.4%	0.9%	1.6%	1.0%	0.6%	1.9%	0.5%	0.5%	1.6%	1.3%	2.7%	1.5%	2.3%	4.7%	0.3%	0.4%
7-8	0.5%	0.8%	1.5%	1.6%	2.2%	1.2%	0.9%	1.3%	0.8%	0.5%	1.3%	1.0%	2.9%	1.5%	7.1%	7.5%	0.2%	0.6%
5-6	1.0%	1.7%	4.3%	3.7%	8.7%	4.0%	2.7%	4.6%	2.3%	1.1%	4.8%	5.3%	5.5%	3.7%	27.8%	25.4%	1.5%	1.9%
3-4	8.0%	12.0%	21.3%	22.9%	23.9%	20.6%	12.2%	29.0%	20.2%	19.4%	20.8%	21.5%	26.1%	18.1%	40.7%	38.7%	29.9%	37.0%
0-2	89.9%	84.7%	71.1%	70.8%	63.1%	72.8%	83.5%	62.9%	76.1%	78.5%	71.4%	70.9%	62.5%	74.9%	21.5%	22.4%	68.0%	59.9%

Source: (Retailer X, 2016. Data extract, Data report)

Figure 3.11 depicts that Gauteng, Mpumalanga, Limpopo, North West and Kwa-Zulu Natal collected at least 90% of orders in less than 7 day transit time. As a result, approximately 10% of orders that were late present an opportunity for improvement for these provinces. Eastern Cape, Western Cape, Northern Cape and Free State collected 70% - 80% of orders in less than 7 day transit time, as a result approximately 20% - 30% of orders that were late present an opportunity for improvement for these provinces. Order fulfilment from the fulfilment began in the latter part of 2015 and 1% of orders were fulfilled from the fulfilment store. Orders delivered via post to Gauteng, Eastern Cape, Free State and Mpumalanga collected at least 50% of orders in less than the 6 days transit time frame as seen in figure 3.12. Kwa-Zulu Natal and Limpopo province were the top two provinces with the highest percentage of transit time above 6 days in 2015. Transit time for deliveries to both provinces scored 76.6% and 70.0%respectively.

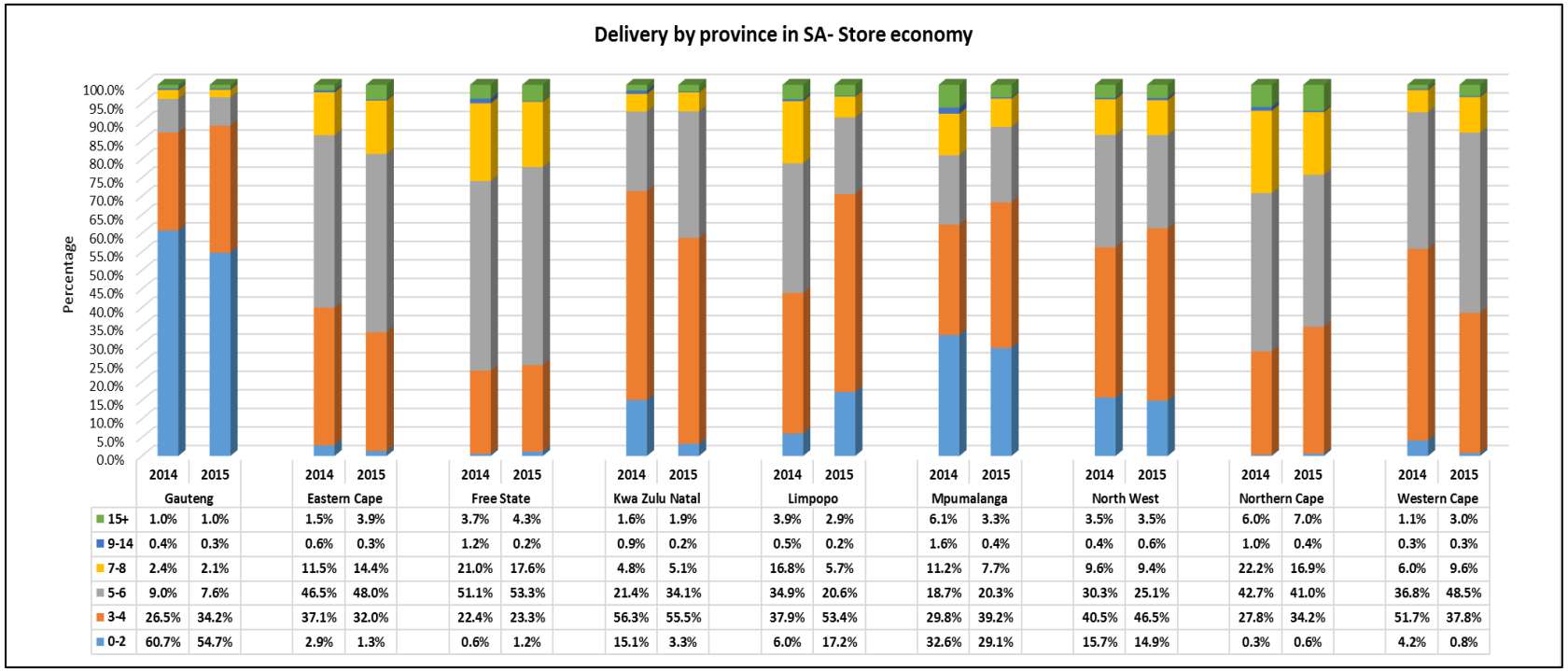
Figure 3.11: Geographical dispersion of store express orders in South Africa



	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
	Gauteng		Eastern Cape		Free State		Kwa Zulu Natal		Limpopo		Mpumalanga		North West		Northern Cape		Western Cape			
15+	0.2%	0.1%	0.4%	0.1%	0.5%	0.4%	0.4%	0.2%	0.2%	0.0%	0.3%	0.0%	0.6%	0.0%	1.1%	0.5%	0.1%	0.1%		
9-14	0.2%	0.1%	0.6%	0.3%	0.3%	0.4%	0.4%	0.2%	0.2%	0.6%	0.5%	0.1%	0.2%	1.6%	1.5%	0.4%	0.1%	0.1%		
7-8	0.2%	0.1%	0.6%	0.3%	0.2%	1.0%	0.5%	0.4%	0.4%	1.7%	0.2%	0.2%	0.2%	0.3%	3.2%	1.8%	0.1%	0.5%		
5-6	1.8%	1.1%	3.0%	2.1%	2.6%	4.4%	1.8%	1.6%	3.9%	3.6%	3.4%	1.9%	3.3%	1.9%	9.4%	5.7%	2.6%	5.5%		
3-4	10.7%	12.1%	43.8%	52.6%	24.9%	26.6%	27.8%	20.4%	25.1%	27.7%	22.0%	20.4%	18.3%	14.4%	41.0%	40.7%	42.5%	57.4%		
0-2	86.9%	86.6%	51.7%	44.5%	71.4%	67.2%	69.1%	77.2%	70.1%	66.3%	73.5%	77.4%	77.4%	81.9%	43.9%	50.9%	54.6%	36.5%		

Source: (Retailer X, 2016. Data extract, Data report)

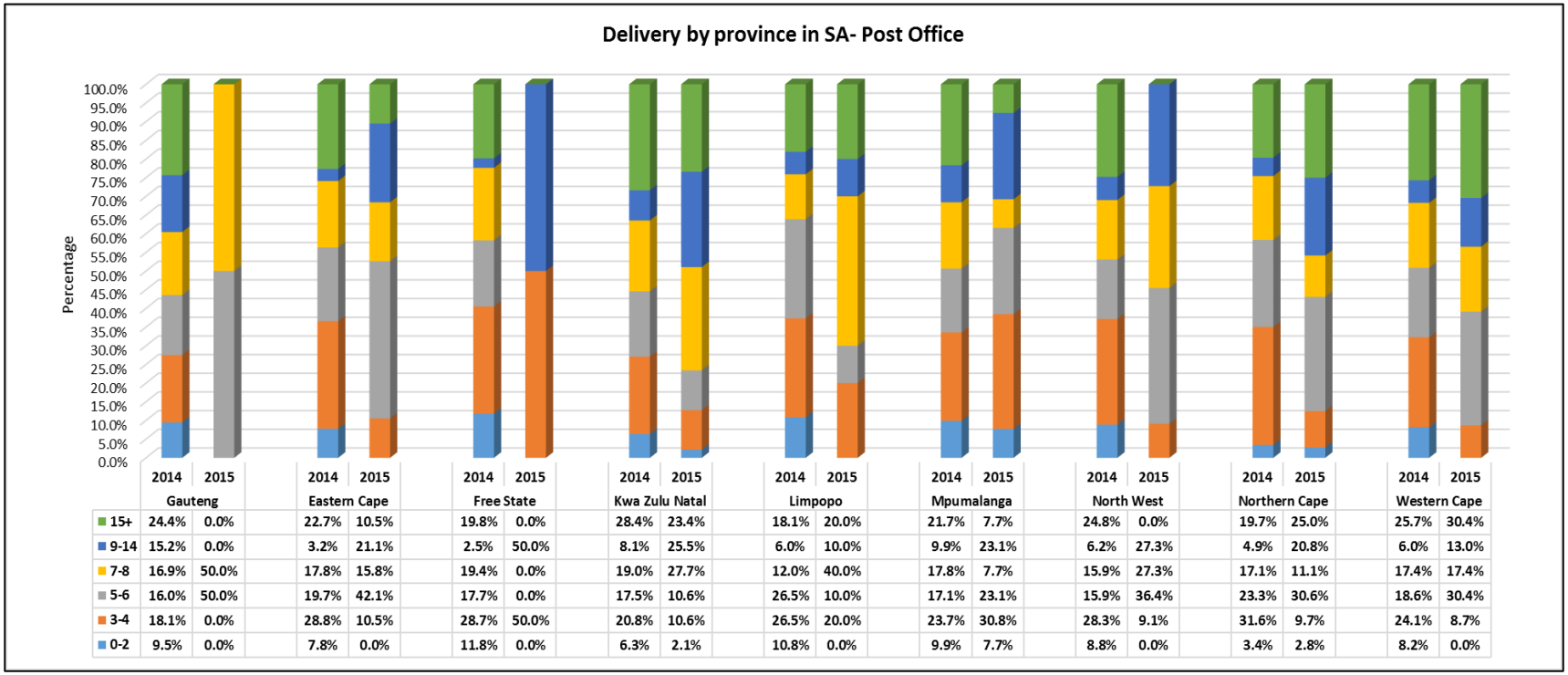
Figure 3.12: Geographical dispersion of store economy orders in South Africa



	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
	Gauteng		Eastern Cape		Free State		Kwa Zulu Natal		Limpopo		Mpumalanga		North West		Northern Cape		Western Cape	
15+	1.0%	1.0%	1.5%	3.9%	3.7%	4.3%	1.6%	1.9%	3.9%	2.9%	6.1%	3.3%	3.5%	3.5%	6.0%	7.0%	1.1%	3.0%
9-14	0.4%	0.3%	0.6%	0.3%	1.2%	0.2%	0.9%	0.2%	0.5%	0.2%	1.6%	0.4%	0.4%	0.6%	1.0%	0.4%	0.3%	0.3%
7-8	2.4%	2.1%	11.5%	14.4%	21.0%	17.6%	4.8%	5.1%	16.8%	5.7%	11.2%	7.7%	9.6%	9.4%	22.2%	16.9%	6.0%	9.6%
5-6	9.0%	7.6%	46.5%	48.0%	51.1%	53.3%	21.4%	34.1%	34.9%	20.6%	18.7%	20.3%	30.3%	25.1%	42.7%	41.0%	36.8%	48.5%
3-4	26.5%	34.2%	37.1%	32.0%	22.4%	23.3%	56.3%	55.5%	37.9%	53.4%	29.8%	39.2%	40.5%	46.5%	27.8%	34.2%	51.7%	37.8%
0-2	60.7%	54.7%	2.9%	1.3%	0.6%	1.2%	15.1%	3.3%	6.0%	17.2%	32.6%	29.1%	15.7%	14.9%	0.3%	0.6%	4.2%	0.8%

Source: (Retailer X, 2016. Data extract, Data report)

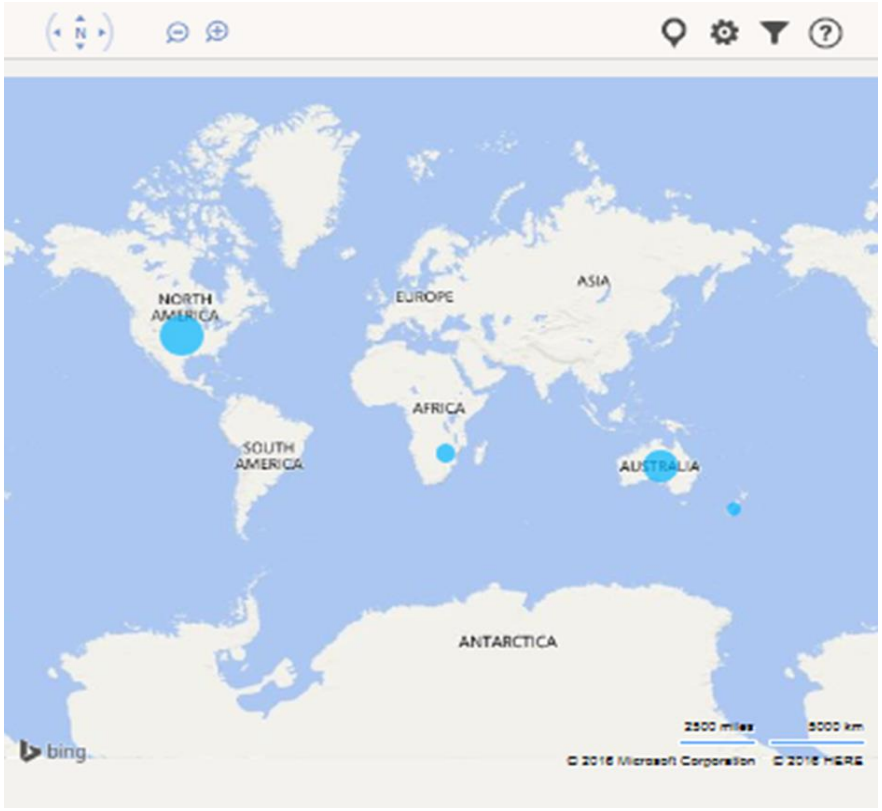
Figure 3.13: Geographical dispersion of delivery via postal orders in South Africa



	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015	2014	2015
	Gauteng		Eastern Cape		Free State		Kwa Zulu Natal		Limpopo		Mpumalanga		North West		Northern Cape		Western Cape	
15+	24.4%	0.0%	22.7%	10.5%	19.8%	0.0%	28.4%	23.4%	18.1%	20.0%	21.7%	7.7%	24.8%	0.0%	19.7%	25.0%	25.7%	30.4%
9-14	15.2%	0.0%	3.2%	21.1%	2.5%	50.0%	8.1%	25.5%	6.0%	10.0%	9.9%	23.1%	6.2%	27.3%	4.9%	20.8%	6.0%	13.0%
7-8	16.9%	50.0%	17.8%	15.8%	19.4%	0.0%	19.0%	27.7%	12.0%	40.0%	17.8%	7.7%	15.9%	27.3%	17.1%	11.1%	17.4%	17.4%
5-6	16.0%	50.0%	19.7%	42.1%	17.7%	0.0%	17.5%	10.6%	26.5%	10.0%	17.1%	23.1%	15.9%	36.4%	23.3%	30.6%	18.6%	30.4%
3-4	18.1%	0.0%	28.8%	10.5%	28.7%	50.0%	20.8%	10.6%	26.5%	20.0%	23.7%	30.8%	28.3%	9.1%	31.6%	9.7%	24.1%	8.7%
0-2	9.5%	0.0%	7.8%	0.0%	11.8%	0.0%	6.3%	2.1%	10.8%	0.0%	9.9%	7.7%	8.8%	0.0%	3.4%	2.8%	8.2%	0.0%

Source: (Retailer X, 2016. Data extract, Data report)

Figure 3.14: Geographical dispersion of online orders internationally

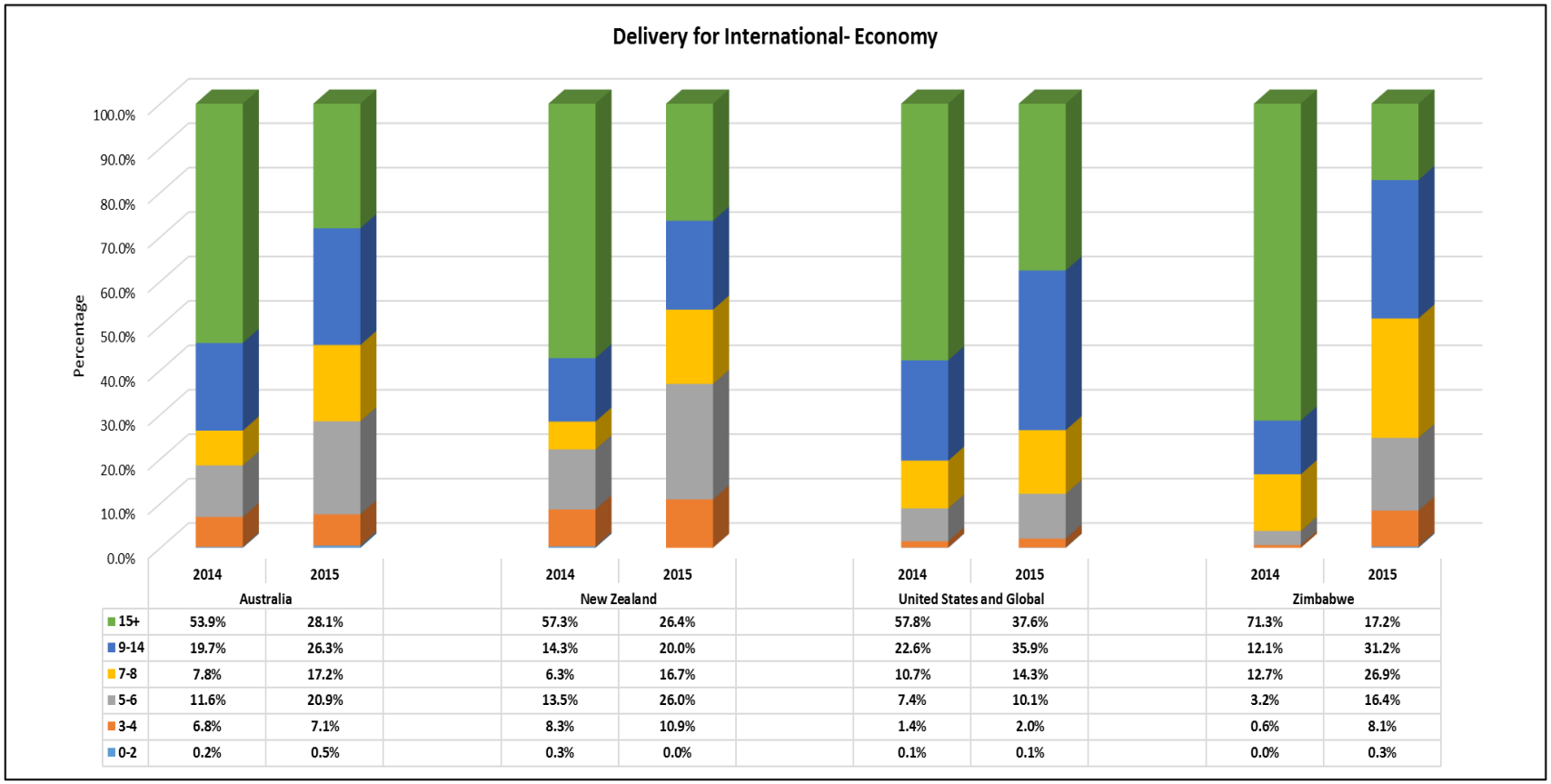


International	
Australia	34.0%
New Zealand	7.7%
United States	41.9%
Zimbabwe	16.5%

Source: (Retailer X, 2016. Data extract, Data report)

Economy orders delivered to Expedited Mail Service (EMS) has approximately 14 days in-transit time to satisfy the SLA. Zimbabwe scored the lowest percentage of orders that were in transit greater than 14 days as seen in figure 3.15 and 3.16. It is presumed that it is attributable to the orders being delivered within Africa in comparison to Australia, New Zealand and United States.

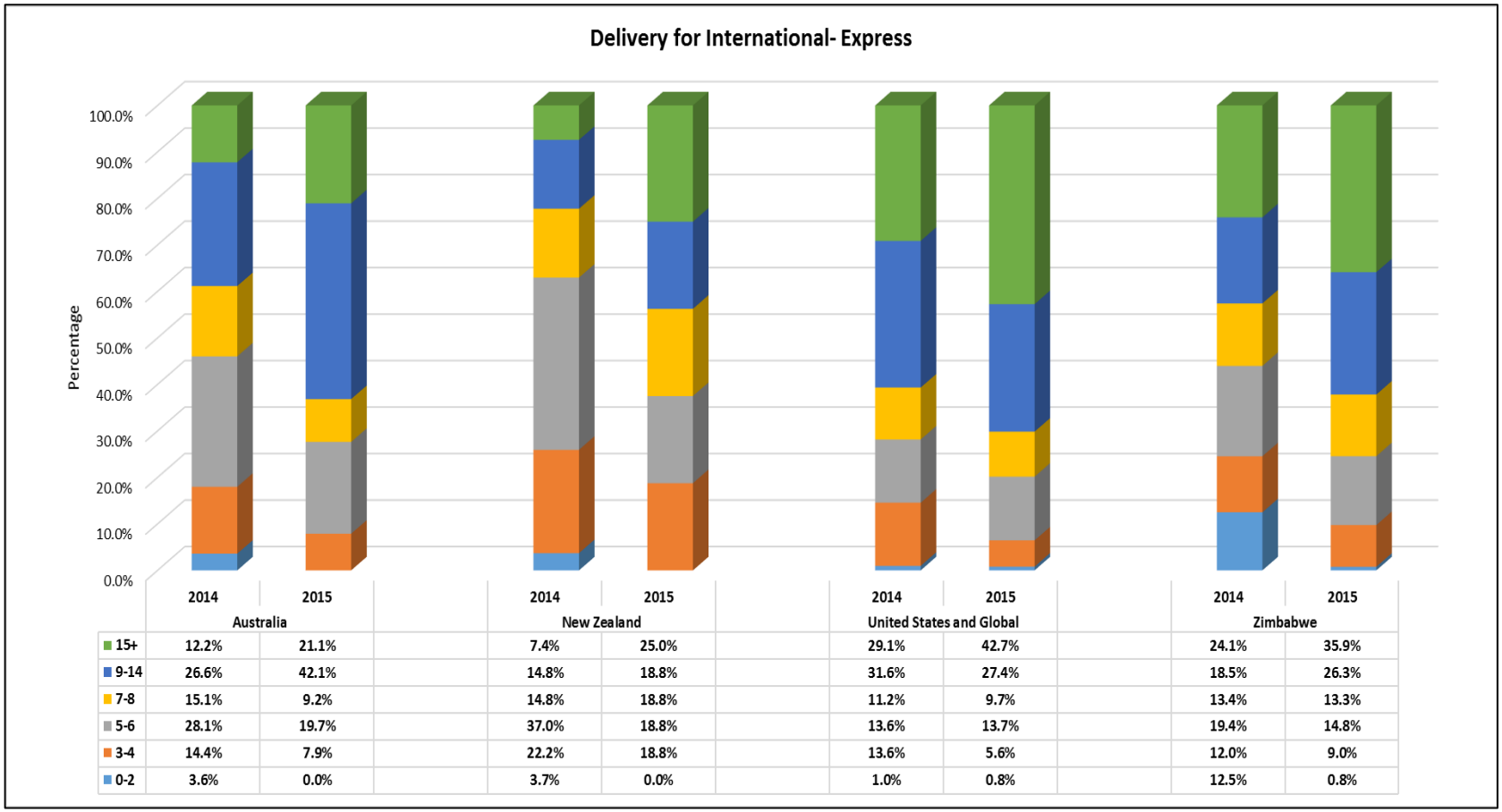
Figure 3.15: Geographical dispersion of online orders internationally- Economy



	2014	2015	2014	2015	2014	2015	2014	2015
	Australia		New Zealand		United States and Global		Zimbabwe	
15+	53.9%	28.1%	57.3%	26.4%	57.8%	37.6%	71.3%	17.2%
9-14	19.7%	26.3%	14.3%	20.0%	22.6%	35.9%	12.1%	31.2%
7-8	7.8%	17.2%	6.3%	16.7%	10.7%	14.3%	12.7%	26.9%
5-6	11.6%	20.9%	13.5%	26.0%	7.4%	10.1%	3.2%	16.4%
3-4	6.8%	7.1%	8.3%	10.9%	1.4%	2.0%	0.6%	8.1%
0-2	0.2%	0.5%	0.3%	0.0%	0.1%	0.1%	0.0%	0.3%

Source: (Retailer X, 2016. Data extract, Data report)

Figure 3.16: Geographical dispersion of online orders internationally- Express



	2014	2015	2014	2015	2014	2015	2014	2015
	Australia		New Zealand		United States and Global		Zimbabwe	
15+	12.2%	21.1%	7.4%	25.0%	29.1%	42.7%	24.1%	35.9%
9-14	26.6%	42.1%	14.8%	18.8%	31.6%	27.4%	18.5%	26.3%
7-8	15.1%	9.2%	14.8%	18.8%	11.2%	9.7%	13.4%	13.3%
5-6	28.1%	19.7%	37.0%	18.8%	13.6%	13.7%	19.4%	14.8%
3-4	14.4%	7.9%	22.2%	18.8%	13.6%	5.6%	12.0%	9.0%
0-2	3.6%	0.0%	3.7%	0.0%	1.0%	0.8%	12.5%	0.8%

Source: (Retailer X, 2016. Data extract, Data report)

3.3 Reverse logistics

In some instances there may be a failed delivery where door to door was nominated as a delivery method. The customer may not be available to receive the order or the customer may refuse delivery. If the customer is not available to receive the order, then the courier returns the order to the nearest depot in the network. The follow up process entails the courier contacting customer care to rearrange for re-delivery of the order. The order is closed once delivered. If the customer refuses delivery, then the courier returns the order to the nearest depot in the network and customer care is made aware. The customer may be credited or the items replaced if it is incorrect or damaged. If a replacement of the items need to be done, the order is picked again and delivered as per the delivery process and the order is closed once delivered. The damaged or incorrect items are assessed for resale once it been delivered to the depot. It is sent to the nearest store if it is in perfect condition. If it is damaged, it is written off to the returns distribution centre and sent there with a consolidated load.

3.4 Conclusion

The case study reveals that whilst parcels are processed through the picking facilities and delivered almost in full and on time for store economy, the other delivery channels for local orders as well as international channels are not meeting the service level agreement. Primary research needs to be conducted to acquire a better understanding of the omni-distribution system and how it has been adapted within the South Africa. Various research methodology need to be analysed and applied by means of a research design.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Research Design

The research design is a time based plan that directs the study by translating research methodology into specific research methods to acquire relevant information through data collection and analysis to answer the research question (Blackmon and Maylor, 2005) and (Hair, Page, Money and Samoul, 2007). Schindler and Cooper (2008:142), identify eight dimensions of a research design and their contribution to the research study: research question crystallization, data collection, variables of the study, the purpose of the study, time horizon, topical scope, research environment and research activity.

Whilst an exploratory study seeks to clarify understanding of an issue by gaining new insight, descriptive studies are an extension which profile people, events and situations (Lewis, Saunders, and Thornhill, 2009: 140). Alternatively, an explanatory study may be adopted to ascertain relationship between variables and understand why phenomena occur (Ritter and Sue, 2012). Variables of the study maybe controlled and manipulated to establish the impact of one variable on another in an explanatory study through the use of experiments. In contrast, an ex post facto design may be used to report the relationship between variables in the natural environment through strict sampling procedures and statistical manipulation without influencing the variables or introducing bias (Ritter and Sue, 2012). There is a need to understand how omni-distribution systems function and to establish how demand driven omni-distribution systems are fulfilling demand orders on time and in full. The study is therefore exploratory and explanatory, adopting a mixed method approach.

Schindler and Cooper (2008:143) distinguish between communication and monitoring as data collection processes. Through personal and impersonal methods such as interviews and self-administered surveys, a communication based study may be adopted. In contrast, monitoring may be utilised through inspection without the need to elicit a response from the subjects. The study is conducted once off and is cross sectional. As the study uses mixed method of exploratory and explanatory approach, a case study and statistical study is being used whereby information is sought from the sample through surveys to identify commonality in themes and patterns and to validate relationships whilst probing further into issues through semi-structured interviews to gain insight for problem solving, evaluation and strategy.

As one of the South African retailers which have expanded their distribution platform to Nigeria, Ghana and Australia and export worldwide, Retailer X is being used as a case study to establish how they have adapted their distribution channels to cope with demand whilst maintaining or enhancing service levels to customers through on time and in full deliveries.

4.2 Data collection instruments

The data collection instruments consist of the survey and interview schedule for the quantitative and qualitative data collection respectively to make up the mixed method approach.

4.2.1. Survey instrument- questionnaire

A survey is a system for collecting data based on the defined objectives with the intention of analysing the results and compiling findings in response to the research question (Ritter and Sue, 2012: 3). In line with the objectives of the study, a self-administered survey instrument is used to solicit information from a multitude of Store and Area Managers who are geographically dispersed. The instrument explores order fulfilment via in-store pick up by customer, customer order satisfaction through on time and in full delivery and product condition, stock replenishment in store and the use of information systems to facilitate order fulfilment through various rating and ranking scales.

Questions were established and sequenced to identify trend, commonality and relationship among variables. The instrument comprises six sections. Sections one and two consists of administrative questions and biographic data respectively. Section three comprises a host of questions pertaining order fulfilment. Section four includes dichotomous questions relating to store operations as part of an omni-distribution system. Section five contains a numerical scale concerning store replenishment and section six assesses the impact of information systems on order fulfilment through omni-distribution through a five point Likert scale which will establish scores for each variable. The respondents were made aware in the e-mail communication and the consent section of the survey that responses are anonymous as the research is being conducted with integrity and in an ethical manner.

4.2.2 Interview schedule

Interviews are useful when complex topics require in-depth information (Rowley, 2012:262). Probing through semi-structured, non-standardized interviews permit the researcher to delve into issues with the flexibility of including unstructured questions to enhance the findings. The questions may vary amongst interviews based on the departmental subject matter being investigated as well as the flow of the conversation (Lewis *et al.,* 2005: 191).

Blackmon and Maylor (2005: 229) prescribe the use of closed-ended questions at the beginning, followed by open-ended questions when rapport has been built with the participants. In contrast, Lewis *et al.,* (2005: 191) suggest the use of funnelling, which is a questioning technique whereby open-ended questions are first asked to gain a broader perspective, followed by more specific questions. The funnelling approach will be applied to gauge the respondents' view of omni-channel retailing, followed by more specific questions relating the effect of omni-distribution on order fulfilment by Retailer X. The inclusion of bias in the interview questions is likely to alter feedback from the respondents hence credibility of the findings (Lewis *et al.,* 2005: 190). Loaded questions and emphasis on certain words introduce bias (Lewis *et al.,* 2005: 191). Dumay and Qu (2011:248) also suggest that closed-ended questions should not be used alternatively with open-ended questions to ensure continuity of the discussion. Furthermore, the use of jargon and double negatives are likely to aggravate respondents. The questions are clear and simple to understand to ensure integrity of the responses. According to Dumay and Qu (2011:249) there are subtleties involved in asking questions based on the typology of the interview. The guide to establishing interview questions by Dumay and Qu (2011:249), adapted from Kvale (1996: 133-5) was used to establish the interview questions. The questions are structured in a logical sequence following the themes of the study. The questions are established to delve into the adaption of distribution systems at department level. Questions are department specific but the main themes such as the implication of distribution processes on order fulfilment and visibility of data through information sharing as presented in underlying themes. Furthermore the questions pertain to the industry and the division's strategic imperatives for omni-channel retailing from which responses are to be transcribed.

4.2.3 Administration of data collection instruments

Surveys are a useful tool to gain information from a large sample in a short space of time however, the response rate may be a limitation if the survey questions are not clear and if the survey is not administered appropriately (Rowley, 2014:314).

Response rate impacts on the representativeness and versatility of the data. According to Greener and Martelli (2015:65), the response rate is calculated using the formula below:

$$\left(\frac{\text{Count of useable response}}{\text{(Total sample –unsuitable or uncontactable units)}} \right) \text{ X } 100$$

The survey was self-administered electronically using a web based questionnaire via Survey Monkey. Although it is a useful tool to gather information quickly, access to Store Managers, Assistant Store Managers and Area Managers is limited. There is either the option of uploading the survey via the store interface, point-of-sale, or via e-mail. Owing to the IT department being constrained for resources and the e-mail method appearing like a more feasible option, the surveys were distributed via e-mail to every store in the sample. The e-mail addresses were acquired from the Networks Team subsequent to gatekeeper's letters and ethical clearance being acquired. Communication was first sent by the Human Resource Executive and Omni-channel Manager to stores advising them of the survey. Thereafter, the stores received the e-mail link and were advised of the purpose of the study, permission that had been granted by the University and Company and consent that has to be granted on the first page of the electronic survey. Respondents were informed that their identity is confidential and by clicking next on the first page of the survey, they consent to take the survey. The respondents were given three weeks to complete the survey and were reminded of the importance of the study and the value of their input on a weekly basis. Subsequent to the deadline, the responses were downloaded from the Survey Monkey tool for analysis.

It is necessary to first conduct the survey and conduct the interview subsequently to ascertain which areas of the study required clarity and supplementary information. Interviews were conducted to gather extensive detail on the topic. Whilst there is opportunity to acquire an abundance of information, the questioning technique and the moderator's demeanour towards the respondents plays a significant role on the outcome of the interview (Rowley, 2012: 265). Dumay and Qu (2011:248) suggest that the interviewer apply patience and exude a non-judgemental attitude to foster a positive relationship with the respondents. The interviews are semi-structured to allow for flexibility to probe for more detail on a topic. A hierarchical questioning structure which sequence the broader questions at the beginning of the interview followed by specific questions was utilized to put the participants at ease. Although an audio recording device was used, notes were also be made during the interviews. It was necessary to listen carefully, extract insights and encourage participation especially in the mini-groups.

Greener and Martelli (2015:113) suggest that interviewees be given a copy of the interview questions in advance to facilitate a reflective response. Furthermore, interview time needs to be planned and sufficient time booked with a considerable margin of time in-between interviews. One mini-group interview was conducted with the Courier and individual interviews were conducted with the remaining respondents. As a result of the respondents being familiar with each other, were comfortable participating in a group discussion. Objectivity and professionalism was applied to the discussions to achieve legitimate feedback from respondents.

4.2.4 Reliability and validity of instruments

Good measurement tools are considered to be reliable and valid when it exhibits precise measurement procedures and is characterised as being fit for purpose (Schindler and Cooper, 2008: 294). Reliability can be measured using test-retest, split-half reliability and Cronbach Alpha for quantitative data (Hair *et al.,* 2007: 242). Test-retest requires that respondents retake a survey under similar conditions and results are compared from both the tests for similarity (Hair *et al.,* 2007: 243). The use of a split-half reliability test entails the scale of items being split into halves by odd and even number, thereafter, comparing the two halves. A high correlation indicates high reliability (Schindler and Cooper, 2008: 294). Using SPSS, the average of the coefficient of all items is calculated to determine the Cronbach Alpha which may range from 0-1. As a rule of thumb, coefficients below 0.7 are considered to be poor and coefficients of 0.7 and above are considered good (Hair *et al.,* 2007: 244). The Cronbach Alpha was used to test reliability, as the level of homogeneity of the questions in the instrument needed to be tested scientifically.

Reliability of the instrument in a qualitative study is established through a measure of quality (Golafshani, 2003: 598). Thomas (2010: 318) elaborates that the quality is reflected by trustworthiness of the research through credibility, transferability, dependability and confirmability. The credibility of the research is the extent to which the research finding matches reality and establishes if there is a match between the constructed realities of respondents and those realities represented by the researcher (Ghauri, Penz and Sinkovics, 2008: 699). Transferability is the extent to which the findings can be generalized. Although it is considered a challenge in qualitative data analysis due to the subjective nature, justification of the methodological approach and a detailed description of critical processes and procedures associates meanings with phenomena (Thomas, 2010: 320). The instrument is dependable when the steps of research can be verified through the examination and reduction of data (Golafshani, 2003: 601). Thomas (2010: 321) notes the following suggestions of Merriam (1998): the assumptions and theory behind the research need to be divulged, a multi-method approach such as triangulation is necessary and there needs to be transparency of the data collection technique.

Confirmability is the corroboration of the findings by personnel such as auditors or others doing similar research as well as through triangulation. Confirmability is achieved through a methodological account of how the research was done and by archiving data for future investigation (Thomas, 2010: 322). Interviews were conducted with senior managers, executives and directors with 15 years or more industry experience. Their experience and position is indicative of credible feedback. The provision of a detailed breakdown of the interview process, transcription of audio recorded interviews and thematic analysis justifies the transferability of the research. The transparency and detailed record of interviews facilitates future corroboration of the result. Reliability of the qualitative instrument is also assessed through the similarity of words and phrases using category reliability or inter-judge reliability (Sekaran, 2010:384). Category reliability entails the researcher categorizing definitions to allow for the classification of data. Well defined categories result in higher category reliability. Inter-judge reliability is the reconciliation of coding decisions between coders. Category reliability was used to identify well defined categories and assign relative variables within the categories. Category reliability was achieved whereby underlying topics were categorised and variables classified within the topics. A Visio mind map was created with omni- channel retailing, demand driven supply chain, order fulfilment omni-distribution and information systems documented as the categories and variables are assigned within the categories. Furthermore, the use of multiple methods and sources of data collection was used to determine if there is commonality in findings, inform further investigation and strengthen findings. Interviews and surveys were conducted and data reports were collected. Data was acquired via multiple sources; Directors, Area Managers, Store Managers and Department Managers to ensure all possible explanations were included. The use of multi-method research achieves credibility, dependability and confirmability of the overall research findings ensuring the data is trustworthy and reliable.

Validity indicates if the instrument measures the concepts being studied (Marsden & Wright, 2010:372). Validity is measured by means of content validity, construct validity and criterion validity. Content validity requires a sample of experts to be consulted to assess the suitability of the items representing a construct on the instrument (Schindler and Cooper, 2008:290). Construct validity determines whether the construct is in fact being measured using convergent and discriminate validity tests. Convergent validity requires for an established construct measuring the same concept to be identified and scores of both constructs to be calculated and correlated (Schindler and Cooper, 2008: 292). Divergent validity requires for an established construct measuring a different concept to be identified and scores of both constructs to be calculated which should most likely be uncorrelated (Schindler and Cooper, 2008:292). Criterion validity determines relative to other variables if the construct performs as anticipated (Schindler and Cooper, 2008:292).

Concurrent validity and predictive validity can be used. Concurrent validity entails a pre-specified association be made between score of the construct being validated and dependent variable (Hair *et al.,* 2007:247). Predictive validity establishes if the construct measured at a point in time can predict another criterion at a later point (Hair *et al.,* 2007:244). The study was based on established supply chain concepts hence construct validity was not necessary nor was criterion validity used since this is an exploratory study. Hence, content validity was used by consulting with supply chain experts and academics for the quantitative and qualitative data collection. Content validity of the survey instrument is also achieved through supporting literature. In addition, the correspondence with the sample respondents as well as the survey document was approved by supply chain experts such as the regional omni-channel manager and the omni-channel Director prior to distribution to the sample. The survey was also piloted when it was sent to 10 stores in the Durban region and the feedback was that supervisors and store associates would not cope with the level of questions. Rather, the instrument could be answered by Store Management and the Area Manager. The survey was subsequently distributed to Assistant Store Managers, Store Managers and Area Managers in Durban, Johannesburg and Cape Town.

4.3 Measurement scales

The survey instrument utilizes rating scales. Rating scales elicit responses concerning an object, event or person whilst ranking scales draw comparisons between objects, events and people to establish a ranks amongst the choice (Sekaran, 2005:140). Nominal scales facilitate the categorisation of variables which have no intrinsic value whilst ordinal scales rank variables in a meaningful way (Sekaran, 2005:140). Interval scales identifies the order of the variables and magnitude of the difference whilst ratio scale also ascertains the proportion of the difference. Nominal scales were used for questions 1-5 as the information is mutually exclusive and collectively exhaustive. Interval and ratio scales were used for questions 6-35 to compute frequency counts and measure central tendency, dispersion and the relationship among variables for sections. The frequency count of responses is a compact representation of responses from the raw data. When data does not have normal distribution, particularly in the case of nominal and ordinal scales, non-parametric statistic such as Chi square is used (Hair *et al*., 2007:333). Alternatively, if there is normal distribution of the data set and interval or ratio scales are used, the use of parametric statistics such as t-test and ANOVA is necessary. Abdulazeez (2014: 3) tabulates commonly used non-parametric and parametric tests in figure 4.1 to compare means and establish the degree of association between variables.

Figure 4.1: Non-parametric and parametric tests

Analysis Type	Example	Parametric Procedure	Nonparametric Procedure
Compare means between two distinct/independent groups	Is the mean annual temperature of extreme southern Kano different from the mean annual temperature of extreme northern Kano?	Two-sample t-test	Wilcoxon rank-sum test
Compare two quantitative measurements taken from the same individual	Was there a significant change in soil fertility between a soil which inorganic fertilizers was applied and the same soil which group which organic manure was applied after one year?	Paired t-test	Wilcoxon signed-rank test
Compare means between three or more distinct/independent groups	If our experiment had three rock types (e.g., igneous, sedimentary and metamorphic), we might want to know whether the mean mineral content at baseline differed among the three groups?	Analysis of variance (ANOVA)	Kruskal-Wallis test
Estimate the degree of association between two quantitative variables	Is excessive deforestation associated with soil erosion?	Pearson coefficient of correlation	Spearman's rank correlation

Source: Abdulazeez, (2014) Difference between non-parametric and parametric tests and their advantages and limitations, Qualitative and quantitative techniques. In: Tanya Hoskin (Undated), Angela Hebel (Undated) and Robson (1994). [Online]. Available: https://www.academia.edu/14662671/Differences_and_Similarities_between_Parametric_and_Non-Parametric_Statistics [21 March 2016]

The variables of the study are classified as dependent and independent. Mbhele (2014: 187), identifies the principles on independent variable and dependent variable on measurement scales as illustrated in figure 4.2. Using the literature of (Sekaran, 2005, Hair *et al.*, 2007, Mbhele, 2014 and Abdulazeez, 2014) questions that utilise a nominal scale are non-parametric and therefore use the Chi square test, interval/ratio questions that are dichotomous required the t-test and binomial test where there were groups of two whilst interval and ratio based questions are parametric which used the Pearson coefficient of correlation.

Figure 4.2: The Principles on Independent variable and Dependent variable on Measurement Scales

The Principles on Independent variable and Dependent variable on Measurement Scales (Babbie and Mouton, 2001:601)		
If Independent Variable is measured at the:	**And Dependent Variable is measured at the:**	**Then use the:**
Nominal/Ordinal level	Nominal/Ordinal level	Chi-square test
Nominal/Ordinal level (Dichotomy#)	Interval/Ratio level (Scale*)	T-test
Nominal/Ordinal level (No dichotomy)	Interval/Ratio level (Scale*)	One-way ANOVA (F-test)
Interval/Ratio level (Scale*)	Interval/Ratio level (Scale*)	Correlation coefficient
# A dichotomy implies a variable with two categories only, such as gender or pass/fail or yes/no. *SPSS does not distinguish between variables on an interval or ratio level but defines both as scale variables.		

Source: Babbie and Mouton (2001:601). In: Mbhele (2014:187). Electronic Supply Chain Management Systems in Managing the Bullwhip Effect on Selected Fast Moving Consumer Goods. PHD. UKZN.

For the qualitative component of the mixed method study, thematic analysis was used with conceptual and relational analysis to identify frequency of concepts and examine the relationship between the concepts.

4.4 Sampling techniques

The study takes the form of a case study research project based on Retailer X's Apparel division, and it's well integrated third party logistics provider City Logistics. The underlying purpose of the study is to establish order fulfilment frequencies through demand driven omni-distribution systems. Non-probability sampling is used in business research case studies in which the research question is explored and theoretical insight gained by not randomly selecting the sample but by using non-probability techniques (Lewis, 2009:233). Non-probability purposive sampling directed the necessary questions to the right people to establish how the operations of this South African based business are competing globally in an omni-channel age. This is particularly important as information needs to be acquired by engaging with specific individuals to gain a thorough understanding in the exploratory study.

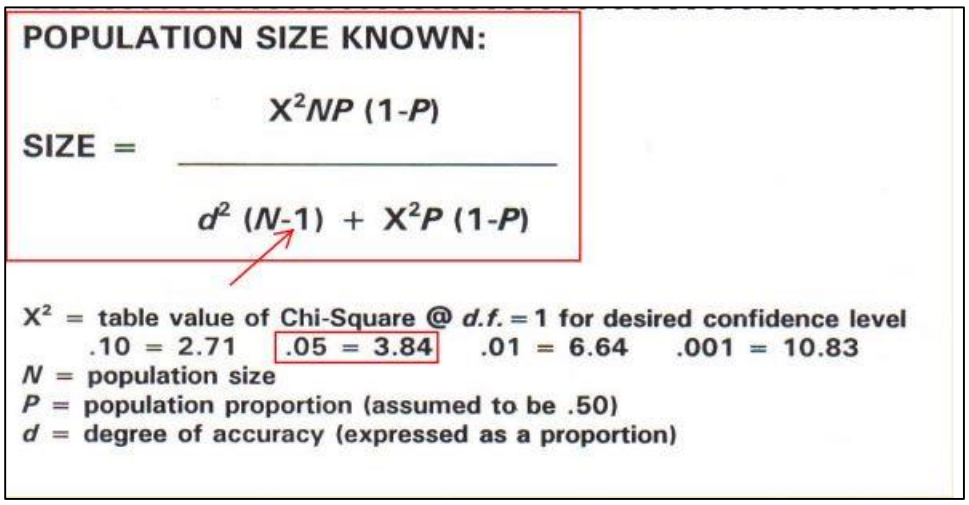
4.4.1 Population size

The population for the quantitative component of mixed method study was 333 Assistant Store Managers, Store Managers and Area Managers from 161 stores in the Durban, Johannesburg and Cape Town regions. These regions are the distribution hubs of the apparel division of Retailer X, as a result, most of the product movement is directed through these hubs. Although surveys were distributed nationally, the study was Durban based as the head office of the company and City Logistics is situated in Durban.

4.4.2 Sample size

The sample size is dependent on the desired precision which is translated into confidence level and size, the dispersion of the population, the population size and population homogeneity. According to Schindler and Cooper, (2008: 408), the level of confidence required is associated with the level of risk of the project. Smaller intervals render greater precision of the sample. Furthermore, the authors add that a smaller dispersion requires a smaller sample to represent the population. Ruddick, Sherwood and Stevens (1983:80), as cited by Ghyoot (1994: 12), suggest that the sample be between 40 and 300 whilst Emory (1985:286), cited by Ghyoot (1994: 12), opposes this view stating that the absolute value of 10% of the population should be used rather than the relative value. More recently, Sekaran (2005:296) cites Roscoe (1975) with three rules of thumb concerning the sample size: firstly, the sample should range between 30 and 500, secondly, sub-samples should constitute a minimum of 30, and thirdly, the sample should be ten times or more as large as the variables in multivariate research. Schindler and Cooper (2008: 408) state that a 95% confidence level is frequently applied to quantitative research studies. Furthermore, Krejcie and Morgan (1970:607), published a sample reference table which assumes a standard error of 5%. When the population size is known, the sample size is calculated using the sample size derivation formula in figure 4.3. The authors highlight that sample size should increase as the population increases at a diminishing rate until the point of 380.

Figure 4.3: Derivation of sample size based on known population



Source: Krejcie and Morgan (1970:607) 'Determining the sample size for research activities'. *The Educational and psychological measurement, 30(1):607-610.* (1970) [Online]. Available: http://home.kku.ac.th/sompong/guest_speaker/KrejcieandMorgan_article.pdf [21 March 2016]

Sekaran (2005:295) also references the Sample Size Decision Table by Krejcie and Morgan. For the purpose of this study, the Sample Size Decision Table was used. Based on a population of 333 Managers from 161 stores and a standard error of 5%, 175 Assistant Store Managers, Store Managers and Area Managers were surveyed for the quantitative component of the mixed method study as tabulated in figure 4.4. Population homogeneity also has an implication on the sample size. Bell and Bryman (2015:200) state that the greater the homogeneity of the population, the smaller the sample needs to be. The population is homogenous in respect of their knowledge of store procedures and operations yet heterogeneous in their experience and interaction with customers. It was therefore feasible to conduct the survey across the three hubs which experience the most amount of inventory movement.

Figure 4.4: Calculation of the population

Stores	**Store/Assistant store manager**	**Area manager**	**Population**
161	2x 161 store managers	=161/ average of 15 stores per area	=322 managers from stores + 11 area managers
	=322 store managers	=11 area managers	=333
			Sample size =175

The sample size for interviews vary based on scope of the research and the proximity of the interviewer to the participant in the case of face-to-face interviews (Schindler and Cooper, 2008: 172). Interviews can take the form or individual in-depth interviews or group interviews which depending on the time frame and nature of the study. Group sizes can consist of dyads, triads, mini-groups (2-6 people), focus groups (6-10 people) or super groups (11-20 people) (Rowley, 2012: 261). Smaller groups are used when extensive detail is required on the topic, or when the population is small. In contrast, focus groups and super groups are used when idea are required in a short space of time through group synergy. In addition, groups can be heterogeneous or homogenous and consist of experts or non-experts (Schindler and Cooper, 2008: 177). The sample consists of 13 senior managers and Directors from Retailer X and City Logistics who were interviewed individually and in a mini-group as tabulated in figure 4.5. The mini-group comprises heterogeneous individuals who are experts in the industry. The heterogeneity of the group of experts permits group synergy and extensive feedback on areas that require in-depth and technical coverage.

Figure 4.5: Breakdown of qualitative sample

Title	Group/Individual
DC Director	Individual
SC Executive	Individual
DC IT Executive	Individual
DC Outbound Manager	Individual
DC Fulfilment Manager	Individual
DC Inbound Manager	Individual
3PL National Fleet Manager	Group 1
3PL Operations Director	Group 1
3PL Managing Director	Group 1
E-com Store Fulfilment Manager	Individual
E-com Online Store Fulfilment Manager	Individual
E-com Manager	Individual
E-com Manager	Individual

4.5 Methods

The use of statistics and thematic analysis contextualizes the research findings. As a result, it is necessary to establish which techniques need to be used.

4.5.1 Quantitative data

The raw data was coded and tabulated into a matrix. Survey Monkey has a feature which can consolidate and analyse the data, however, the responses were only consolidated on Survey Monkey. The data was exported to SPSS as it is more advanced with additional processing capability.

4.5.1.1 Univariate analysis

Univariate tests measure a single variable at a time and is useful when data needs to be summarised and described (Blackmon and Maylor, 2005:309). Descriptive statistics is measured prior to sophisticated statistical techniques being used. It provides additional information through the use of central tendency and dispersion. Central tendency describes the central point of a measure whilst dispersion measures how vastly data is spread around the central point (Blackmon and Maylor, 2005:309).

The arithmetic average, midpoint of the dataset and most frequently occurring answer was established via the calculation of the mean, mode and median respectively. When data exists midway between the maximum and minimum and is symmetrically distributed, it has been normally distributed. In contrast, if data is asymmetrical, it lies more above or below the mean, it is said to be skewed. The standard deviation identifies the central tendency and dispersion of the data. Distribution is measured by how close or spread out the data is relative to the mean or edges. If the responses are significantly close to the mean or to the edge in contrast to normal distribution, the distribution is described as Kurtosis (Blackmon and Maylor, 2005:313). Positive Kurtosis is a result of data residing closer to the mean and negative Kurtosis is attributable to data residing closer to the tail. A higher standard deviation is attributable to greater variation around the mean. Descriptive statistics is only applicable to specific measurement scales. According to Greener and Martelli (2015:75), bar charts, histograms and pie charts are frequently used for nominal and ordinal variables. Furthermore, the mean is calculated for interval variables whilst the median is calculated for interval and ordinal variables and the mode for all variables.

4.5.1.2 Bivariate analysis

Bivariate analysis measures the relationship between two variables whereby the variation in one variable may coincide with the variation in another or it may be attributable to cause and effect (Hair *et al.,* 2007:337). Cross-tabulation and correlation analysis may be used to examine data. Cross tabulation compares categorical data and correlation analysis establishes the covariance between two ranked or numerical variables. Greener and Martelli (2015:78) explain that the direction of the relationship is expressed with either a positive or negative sign. +1 implies a perfect positive relationship whereby an increase in one variable influences the other variable to increase. In contrast, -1 implies that there is a perfect negative relationship whereby a decrease in one variable causes a decrease in another (Greener and Martelli, 2015:78). The strength of the relationship is revealed through the absolute value of the number. Whilst 1 indicates a perfect relationship, 0 indicates no relationship. Spearman's rank correlation is used for non-parametric variables as per figure 4.1 of section 4.3. Greener and Martelli (2015:78-79) add that ETA and Phi coefficient can also be used to establish the strength of the relationship. ETA is used for nominal variables whilst Phi coefficient is used for two dichotomous nominal variable. In contrast, the coefficient of determination (denoted by r^2) assess the strength of the relationship between a numerical dependent and independent variable (Lewis *et al.*, 2009:461). By calculating the proportion of variation between the dependent and independent variable it can assume any value between 0 and +1 with 0 being the least accurate and +1 being the highest accuracy.

Tests can be performed based on the measurement scale of the variables to ensure the findings about the sample can be applied to the population (Greener and Martelli, 2015:80). Non-parametric tests applicable for bivariate analysis are Wilcoxon rank-sum test, Chi-square, Fisher's exact test and Binomial test. The Wilcoxon rank-sum test measures the direction and magnitude of the matched pairs (Parumasur, 2011: 51). Chi square test can be conducted by calculating the chi square value of both variables and the associated level of statistical significance (Rowley, 2014:325). The test requires the categories to be mutually exclusive. If the result presents a large value and ($p<0.05$), then there is association between variables. In contrast, if the results presents a small value and ($p>0.025$), then there is not association between the variables (Diener-West, 2008:15). Fisher's exact test establishes the significance in the difference between proportions of one variable against another (McDonald, 2014: 77). Binomial tests are used to establish the count of times one of two alternatives were selected (Abdi, 2007:3). It tests the probability of achieving the expected outcome from each respondent in the sample, represented by p. In larger samples, p is obtained by calculating a z score. If $p<0.05$, there is a high level of statistical significance. The Chi square test, Fisher's exact test and binomial test were performed on non-parametric questions.

Parametric analysis usually makes use of contingency tables and regression analysis (Rowley, 2014:325). Using contingency table patterns of association in data are identified through the frequency of two occurrences between two ordinal variables. Regression analysis is used to find the correlation and line of best fit between the variables (Rowley, 2014:325). It calculates the value of one variable based on the value of another to establish the trend. The linearity between the variables is the extent to which the change in the independent variable influences the dependent variable. Lewis *et al.,* (2009:462) identifies three common uses of trend analysis; firstly, it identifies the change in variables over time, secondly, the change of variables at different magnitudes can be established, thirdly, long term forecasts can be ascertained. Levene's test may also be used to test the equality of variances amongst independent groups (Starkweather, 2010).

Parametric tests used are t-test, analysis of variance (ANOVA) and Pearson's r. T-tests can be singe sample or two sample. Single sample T-tests are used to test observed frequencies such as the mean against expected frequencies when there is a single sample and the hypothesis is based on a specific population (Schindler and Cooper, 2008: 482). The two sample T-test compares the difference between two unrelated means (Hair *et al.,* 2007:314-343). If two variables are measuring the same characteristics under different conditions, the paired t-test may be used. ANOVA measures the statistical difference between the average of the means (Hair *et al.,* 2007:314-343). To use ANOVA, the sample must be randomly selected and the population should have equal variance.

Pearson's r is used for interval variables which can be presented in a scatter diagram to illustrate the linear relationship (Hair *et al.*, 2007:314-343). The interpretation of the result is the same as Spearman's rank correlation whereby the direction and strength of the relationship is identified by 0 - ±1. The contributors to visibility and processing agility on time and in full deliveries were tested to establish the extent to which these variables are influenced by using a two tailed single sample T-test with a 95% confidence interval. If $p<0.05$, there is a high level of statistical significance.

4.5.1.3. Hypotheses testing

The statistical significance or insignificance of the difference between the sample and population has to be tested using hypothesis testing. The null hypothesis, represented by (H_0), states that there is no difference between the population and sample for the parameter being tested and the alternate hypothesis, represented by (H_A), indicates that there has been a change (Schindler and Cooper, 2008: 470). The hypothesis is tested using a two tailed or one tailed test. The former considers the probability of a likely and unlikely outcome represent by both tails of the normal distribution curves whilst in contrast, the latter only considers the probability of an unlikely outcome specified by the tail of the alternative hypothesis (Schindler and Cooper, 2008: 471). According to Parumasur (2011: 48), 0.025 and 0.05 is the observed level of significance for two tailed and one tailed tests respectively. If $p < 0.025$ for two tailed test, reject the null hypothesis and accept alternative hypothesis and if $p < 0.05$ for one tailed test, reject the null hypothesis and accept the alternate. Type 1 and 2 errors may occur during hypothesis testing. Type 1 error is when the null hypothesis was rejected when it was true and type 2 error is when the null hypothesis was not rejected when it was false. Statistical power influences the level of error. The closer the statistical significance(α) is to zero, the smaller the difference in the size of the population and the larger sample size at a given level of α the higher the power (Sekaran, 2005: 337). Mbhele (2014) outlines four steps for testing: firstly, state the hypotheses, secondly, establish a plan to perform the analysis, thirdly, analyse the sample data and fourthly, interpret the results.

4.5.1.4 Multivariate analysis

Multivariate analysis is useful when there are a number of factors that contribute to a phenomena, hence the correlation and co-variance between a group of variables needs to be established (Rowley, 2014:326). Multiple regression, discriminant analysis, logistic regression, factor analysis and cluster analysis are techniques used to perform multivariate analysis. Multiple regression, discriminant analysis and logistic regression are dependence methods in which the relationship between dependent and independent variables are established (Rowley, 2014:326).

In contrast, factor analysis and cluster analysis are interdependence methods in which there are no assumptions about the independent and depend variables (Hair *et al.*, 2007:368). Multiple regression analysis is similar to bivariate regression analysis with the exception that more than one independent variable is used to explain the degree and type of relationship between independent variables and the dependent variable (Sekaran, 2005:350). According to Lewis *et al.*, (2009:462) the use of multiple regression analysis warrants the following factors to be considered :the linearity of the variables, homoscedasticity, heteroscedasticity and multicollinearity.

a. Linearity of the variables

In the case of multiple variables, the relationship between the dependent variables and multiple independent variables is established (Lewis *et al.,* 2009:462). It is necessary to identify and exclude outliers from the regression analysis to not skew the assumption of the linearity.

b. Homoscedasticity and heteroscedasticity

Homoscedasticity is the extent to which the dependent and independent variables have equal variances (Lewis *et al.,* 2009:462). The Levene test for homogeneity may be used to establish the equality of variances. Heteroscedasticity exists if the values for the dependent and independent variables have unequal variances (Lewis *et al.,* 2009:462). According to Lewis *et al.,* (2009:463) analysis can still be conducted even if heteroscedasticity exists.

c. Multicollinearity

Multicollinearity is encountered when two or more independent variables are highly correlated which makes the estimation of regression coefficients unreliable (Lewis *et al.,* 2009:463). Furthermore, perfect correlation of the independent variables makes estimation of regression coefficients impossible. Common measurements used to identify multicollinearity are tolerance value and the variance inflation factor (VIF), the inverse of tolerance value. Both measurements indicate the extent one independent variable is influenced by another with a maximum value of 0.10 and 10 for each measure respectively. According to (Sekaran, 2005:352) it is only a problem if the regression of coefficients has to be calculated, otherwise, it is not problematic if forecasting needs to be performed. Multicollinearity can be reduced by utilizing independent variables that are not co-linear, utilizing advanced analysis such as ridge regression and creating a new variable which is composite of the correlated variables.

Interdependence methods such as discriminant analysis establishes which independent variables discriminate the nominally scaled dependent variables. Logistics regression is similar to regression analysis due to it also measuring predictive capability of the independent variables. The basis of Factor analysis is concerned with the grouping of variables into categories whilst in cluster analysis; variables are assigned to categories based on the similarity of characteristics and conclusions are established based on those characteristics (Blackmon and Maylor, 2005: 336). Multivariate analysis of variance (MANOVA) assess the difference across multiple dependent variables in contrast to ANOVA which assesses a single dependent variable (Hair *et al.*, 2007:351). It simultaneously tests all variables and their interrelationships by exploring the similarities and differences of multivariate mean values of multiple populations (Schindler and Cooper, 2008: 552). The exploratory nature of the study utilizes univariate and bivariate analysis since phenomena are being investigated. Multivariate analysis would have been used if there was more information on omni-distribution in retail. The explanatory component of the study was investigated through the use of qualitative data.

4.5.2 Qualitative data

The diverse nature of semi-structured interviews does not utilize standardized analysis techniques. As a result, data may be analysed by summarising meaning, structuring meanings or categorising data (Lewis *et al.*, 2005: 490). Notes and transcripts from the interview can be summarised into key points. This method familiarise the researcher with the primary themes and relationships. Alternatively, data may be structured using a narrative approach to elicit in-depth information. Respondents provide feedback in the form of narratives which are usually sequential and is of significance to the researcher as the depth and integrity of the information is profoundly meaningful to the study. In contrast, categorisation, through thematic analysis, solicits the assignment of fragmented data to categories to identify relationships and test hypothesis. It entails organizing, categorising and coding the data to facilitate with the interpretation of data to present the findings (Rowley, 2012:268). Interview codes are identified to organize the data coherently and key themes identified. Rowley (2012:268) suggests that interview questions are a good basis for key themes for a semi-structured interviews. Key themes and sub-themes form the basis of the narrative findings. Text is subsequently coded from the set out themes which facilitate the interpretation of the data into information. Categorisation and summarisation was utilised to explore the contribution of each department towards fulfilling customers' orders on time and in full. Whilst the research objectives are the basis of the interview questions, the non-standardised nature of the semi-structured approach solicits department unique information. Interviews were transcribed, categorised in line with the research objectives and summarised as part of the mixed method study.

4.6 Data analysis- The application of mixed method research

A quantitative and quantitative research was undertake to establish how the use of multiple distribution channels are contributing towards stock replenishment and in-store order fulfilment, as well how information systems facilitate an omni-distribution approach. Whilst the surveys contribute to investigating stores operations, the interviews probe further into issues to gain a more extensive understanding of phenomena. Abfalter, Muller and Raich (2014:737) distinguish between triangulation, mixed method and the hybrid approach by identifying the focus of the study, data sets used, analysis methods and degree of integration of the methods as illustrated in figure 4.6. According to Davis and Golicic (2012:727), a mixed method study combines quantitative and quantitative research approaches of a single study to fully understand phenomena and reduce bias associated with the use of a single method. Abfalter *et al.,* (2014:737) support Davis and Golicic and add that triangulation seeks to combine different methods with the intention of unpacking complex relationships in the study either through a comparative, convergent, or sequential design. The authors are of the view that a combined approach should utilize an intertwined analysis, known as the hybrid approach.

Figure 4.6: Comparison between triangulation, mixed methods and hybrid approach

	Methodological triangulation	Mixed methods approach	Hybrid approach
Focus	Holistic view of phenomenon	Holistic view of phenomenon	Holistic view of (textual) data set
Data sets used	Multiple data sets	Multiple data sets	One or more (textual) data sets
Analysis methods used	Qualitative and/or quantitative methods	Qualitative and/or quantitative methods	Qualitative and quantitative methods
Degree of integration of analysis methods used on the same data set	Low (analysis method is chosen according to each data set)	Moderate (integration occurs not during analysis but in the conclusion)	High (simultaneous application of different analysis methods)

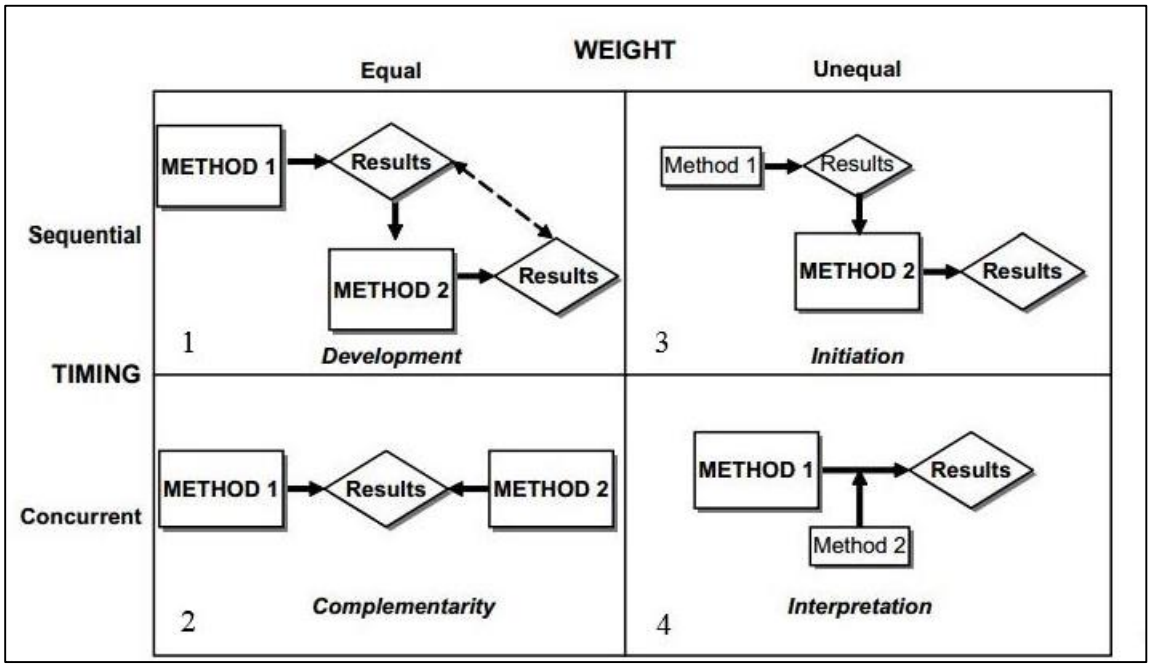
Source: Abfalter *et al.*, (2014:740) Hybrid analysis of textual data, Management Decision. 52(4): 737-754 [Online]. Available: http://www.emeraldinsight.com.ukzn.idm.oclc.org/doi/pdfplus/10.1108/MD-03-2012-0247 [28 March 2016] Abfalter, Muller and Raich

All three techniques apply a holistic view of multiple data sets using quantitative and qualitative methods of analysis, however, the degree of integration between the three approaches differs (Abfalter *et al.,* 2014:740). Triangulation employs a low degree of integration whereby the analysis method is selected based on the data set and interpretation of phenomena is done separately.

Mixed method approach employs a moderate level of integration whereby integration occurs at the interpretation and conclusion stage of the study. Abfalter *et al.,* (2014:740) state that the Hybrid approach uses specialised software, GABEK-WinRelan, in contrast to other Computer Assisted Qualitative Data Analysis (CAQDAS) which combines qualitative analysis procedures , such as coding and evaluating, with quantitative analysis procedures, such as counting and cluster analysis, to culminate a single data. The integration occurs at the beginning of the analysis process. The research uses a mixed method approach with a moderate level of integration as the GABEK-WinRelan software and similar software is not available to the researcher. Hence SPSS and manual qualitative analysis was performed separately but the interpretation and conclusion will be integrated.

Although Abfalter *et al.,* (2014:737) are in support of the hybrid approach, they cite the views of Baraldi and Bocconcelli (2001), Brewer and Hunter (2006) and Greene (2007) that a mixed method approach is useful as it stimulates new idea and theoretical imagination. Davis and Golicic (2012:727) who use the terms triangulation and mixed –method research interchangeably cite Denzin (1978) stating that the mixed-method approach describes investigations with the use of numerous sources and methods. It consists of within-method and across-method techniques. The former utilizes multiple qualitative or quantitative approaches, observation and interviews; surveys and experiments, whilst the latter combines quantitative and quantitative methods (Davis and Golicic, 2012:728). A combination of quantitative and quantitative methods, survey and interviews, have been used in the study. Hence, the mixed-method technique was applied. Davis and Golicic (2012:731) explore mixed method research with the use of weighting and time dimension as illustrated in figure 4.7.

Figure 4.7: Mixed method research



Source: Davis and Golicic (2012) Implementing mixed methods research in supply chain management, International Journal of Physical Distribution & Logistics Management. [Online]. Available: http://www.emeraldinsight.com.ukzn.idm.oclc.org/doi/pdfplus/10.1108/09600031211269721 [28 March 2016]

The quantitative and qualitative methods can be conducted sequentially or concurrently and can carry an equal or unequal weighting in the study. The timing of when the methods are conducted and the weighting of each method is supported by the purpose of the study. A sequential study entails the second method being conducted subsequent to the researcher acquiring the results of the first method. The findings of the first method can guide the questions of the second method. Depending on whether the research wants an equal or unequal weighting applied to the method, the research can be used for development or initiation as per quadrant 1 and 2 respectively. The development approach is used so that one method can inform another thereby exploring the research problem and combining findings by comparing and contrasting the results of each method (Davis and Golicic, 2012:734). The initiation approach is used when one method serves to launch the main method. It is similar to development approach with the exception that the second method is assigned a greater weight as it is the main approach due to the need for preliminary exploration of phenomena in the study. A concurrent study entails both research methods being conducted at the same time due to the sequence not being relevant because one method does not influence the other. The methods can use a complementary or interpretative approach as illustrated in quadrants 3 and 4 respectively.

The complementary approach seeks to examine different aspects of the same phenomena which are complementary with an equal weighting assigned to both approaches (Davis and Golicic, 2012:736). Data is analysed and interpreted thereafter into one report. This approach is useful when more than one perspective needs to be analysed without the influence of the other. The interpretative approach differs from the concurrent study due to its utilizing a weighting to support and confirm findings of the first study.

This study was undertaken to explore omni-distribution as it is a contemporary topic in South Africa with little literature. The exploratory and explanatory nature of the study seeks to explore new phenomena and understand the relationship between variables. The study utilizes the development approach which is sequential and equally weighted whereby the findings of the survey inform the questions in the interviews rather than confirming findings of the first approach. This approach is necessary to enhance the quality of the research as the surveys attain valuable information whilst interviews offset the lack of depth and inflexibility of the survey. Research conducted by Davis and Golicic (2011:728) elaborates that pragmatism is the philosophical foundation of the mixed method approach as it supports the use of combined research. Pragmatism comprises observable phenomena and subjective meanings as an acceptable source of knowledge which is integrated to interpret the data (Lewis *et al.,* 2009:119).

4.7 Conclusion

The study adopts a mixed method approach to gauge a better understanding of concepts through surveys which will be analysed using descriptive and inferential statistics to subsequently inform interview questions to gain an in depth understanding of various phenomena. The experience and seniority of the respondents enhances the credibility of feedback. In addition, the utilisation of the multimethod research approach along with the application of category reliability and content validity of the instruments strengthens findings. The findings from the survey and interviews will be integrated to establish how demand driven omni-distribution systems are fulfilling demand.

CHAPTER FIVE

DATA ANALYSIS AND PRESENTATION OF RESULTS

The perceptions of the respondents were analysed and interpreted from the surveys and interviews to establish from a demand driven model, whether customer orders need to be frequently fulfilled on time and in full with the use of flexible omni-distribution networks with a real time, highly granular view of inventory across channels.

5.1 Survey

The survey instrument comprises univariate and bivariate data. Surveys were used to investigate the current state of the omni-channel which serves to inform the other research methods of the mixed method study.

5.1.1 Univariate and bivariate data

Univariate analysis measure a single variable at a time and is useful when data needs to be summarised and described (Blackmon and Maylor, 2005:309). Frequency distribution is represented through bar charts, histograms and pie charts and descriptive statistics particularises central tendency and dispersion of data to measure variability. Bivariate analysis measures the relationship between two variables whereby the variation one variable may coincide with the variation in another or it may be attributable to cause and effect (Hair *et al.*, 2007:337). Binomial tests are used for dichotomous variables.

5.1.1.1 Frequency Distribution and Descriptive Statistics

Frequency is a count of times a phenomena occur which is represented as a percentage or cumulative percentage (Parumasur, 2011: 46). Frequency is used to identify commonality in responses which will be represented graphically using barcharts. The binomial tests are used to establish whether the observed distribution of a dichotomous variable is the same as what is expected from a specified binomial distribution. By default, each named variable is assumed to have only two values, and the distribution of each named variable is compared to a binomial distribution with p (the proportion of cases expected in the first category) equal to 0.5. If $p<0.05$, there is a high level of statistical significance and $p<0.025$ for a two tailed test.

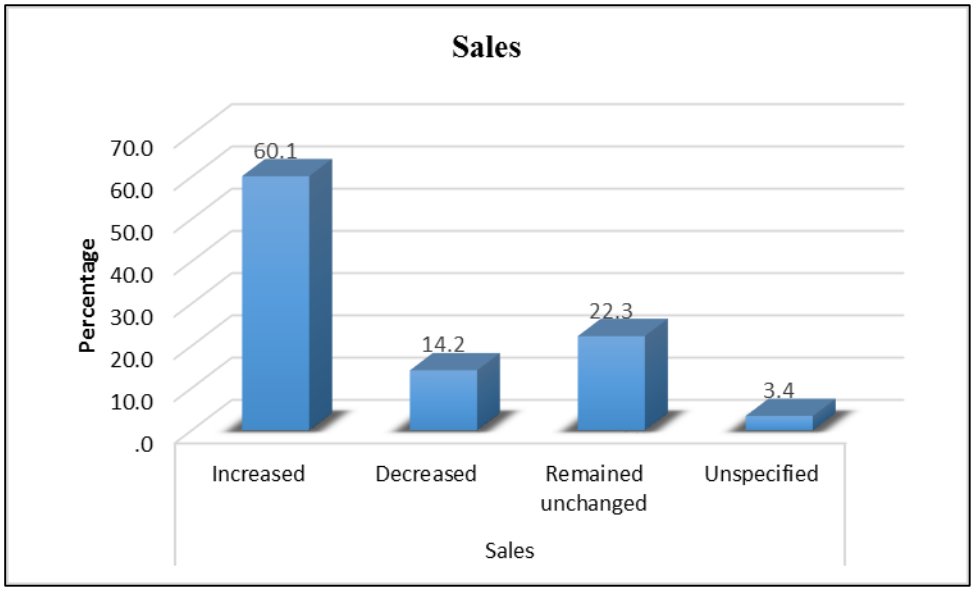
The sample comprised of 175 respondents of which the response rate was 85% (148 responses). The useable responses comprised 70% of middle and senior management (section 3.1, table 2 of the appendix). Approximately 68% of the respondents have more than 5 years managerial experience of which 56% have more than 10 years managerial experience (section 3.1, table 3 of the appendix). This result indicates that majority of responses are from the group of experienced managers. Using SPSS, the average of the coefficient of all items is calculated to determine the Cronbach Alpha. Coefficients below 0.7 are considered to be poor and coefficients of 0.7 and above are considered good (Hair *et al.*, 2007: 244). The questions scored 0.945 using the Cronbach Alpha implying that the sample is reliable.

Table 5.1: Cronbach Alpha

Reliability Statistics

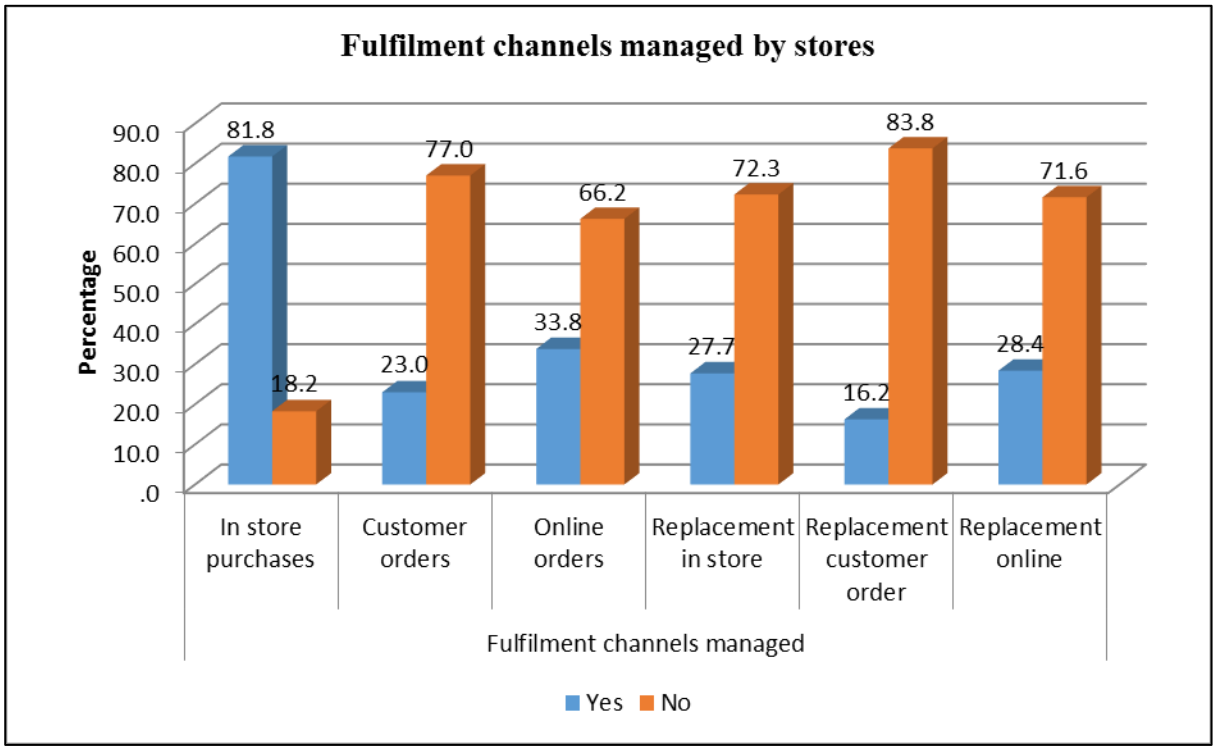
Cronbach's Alpha	N of Items
.945	61

Figure 5.1: Sales



Respondents were questioned whether the extension to online buying increased, decreased or had no influence on sales. Figure 5.1 reflects that 60.1% of respondents are of the view that the extension to online buying increased sales.

Figure 5.2: Fulfilment channels



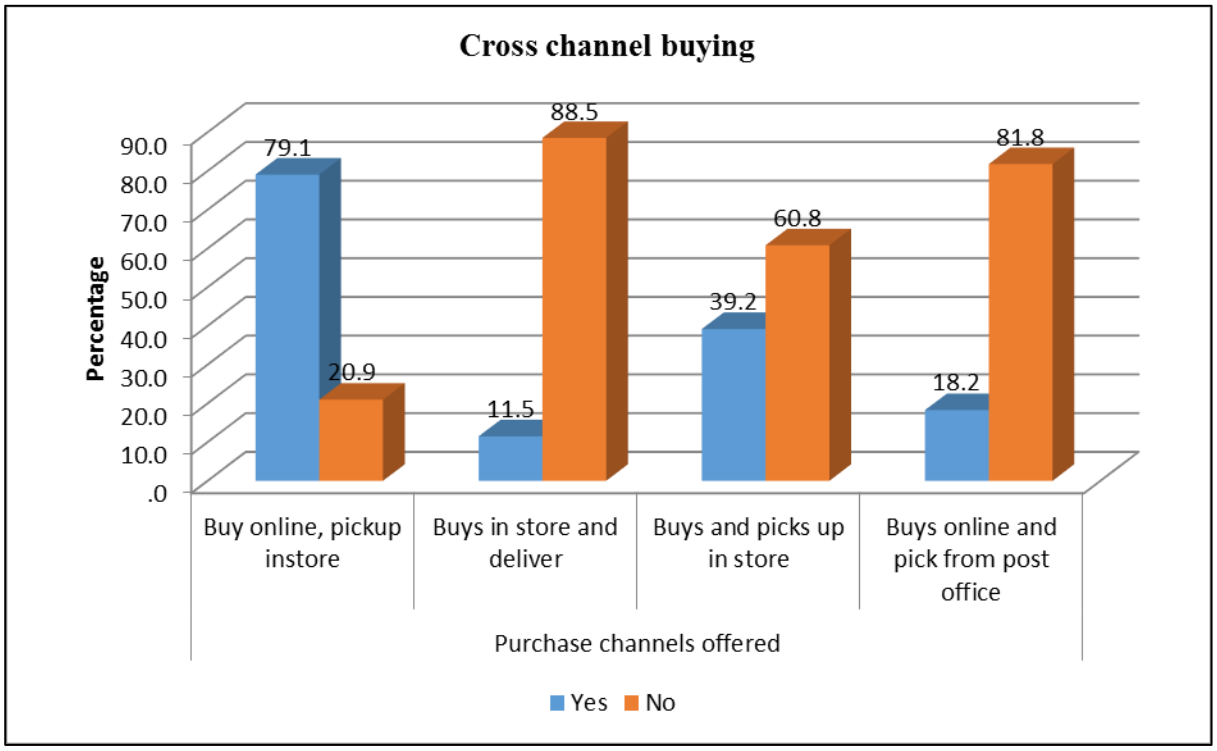
Respondents had to select the fulfilment channels managed by their branch to reveal the current assortment of channels managed by the stores in the apparel division of the company. The result is that 82% of the respondents selected in-store purchases as a major fulfilment channel whilst the remaining respondents did not select in store purchases. Online orders were the second most nominated fulfilment channel which represents 33.8% of responses whilst the remaining respondents stated that online orders were not managed by their store. The remaining fulfilment channels of replacement of online orders, replacement of in-store orders, fulfilment of customers' orders and the replacement of customer order was selected by less than 30% of the respondents.

Binomial test was done based on the standard score (z) approximation as depicted in table 5.2. Where *p* is the probability that answers were chosen systematically and z is the normal random variable of a standard normal distribution. A significant proportion indicated that in store purchases are managed by the branch (82%, $p< 0.025$); a significant proportion indicated that the branch does not manage: customer orders (77%, $p< 0.025$); online orders (66%, $p< 0.025$); replacement in-store (72%, $p< 0.025$); replacement of customer order (84%, $p< 0.025$) and replacement of online order (72%, $p< 0.025$). The results are indicative that the brick and mortar functions are predominant within the brick and mortar operation. However, brick and mortar is being used to fulfil orders from other channels.

Table 5.2: Binomial Test - Fulfilment channels

Fulfilment Channels	Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
In store purchases	Yes	121	.82	.50	.000[a]
	No	27	.18		
	Total	148	1.00		
Customer orders	Yes	34	.23	.50	.000[a]
	No	114	.77		
	Total	148	1.00		
Online orders	No	98	.66	.50	.000[a]
	Yes	50	.34		
	Total	148	1.00		
Replacement in store	Yes	41	.28	.50	.000[a]
	No	107	.72		
	Total	148	1.00		
Replacement customer order	No	124	.84	.50	.000[a]
	Yes	24	.16		
	Total	148	1.00		
Replacement online	Yes	42	.28	.50	.000[a]
	No	106	.72		
	Total	148	1.00		

Figure 5.3 Cross channel buying



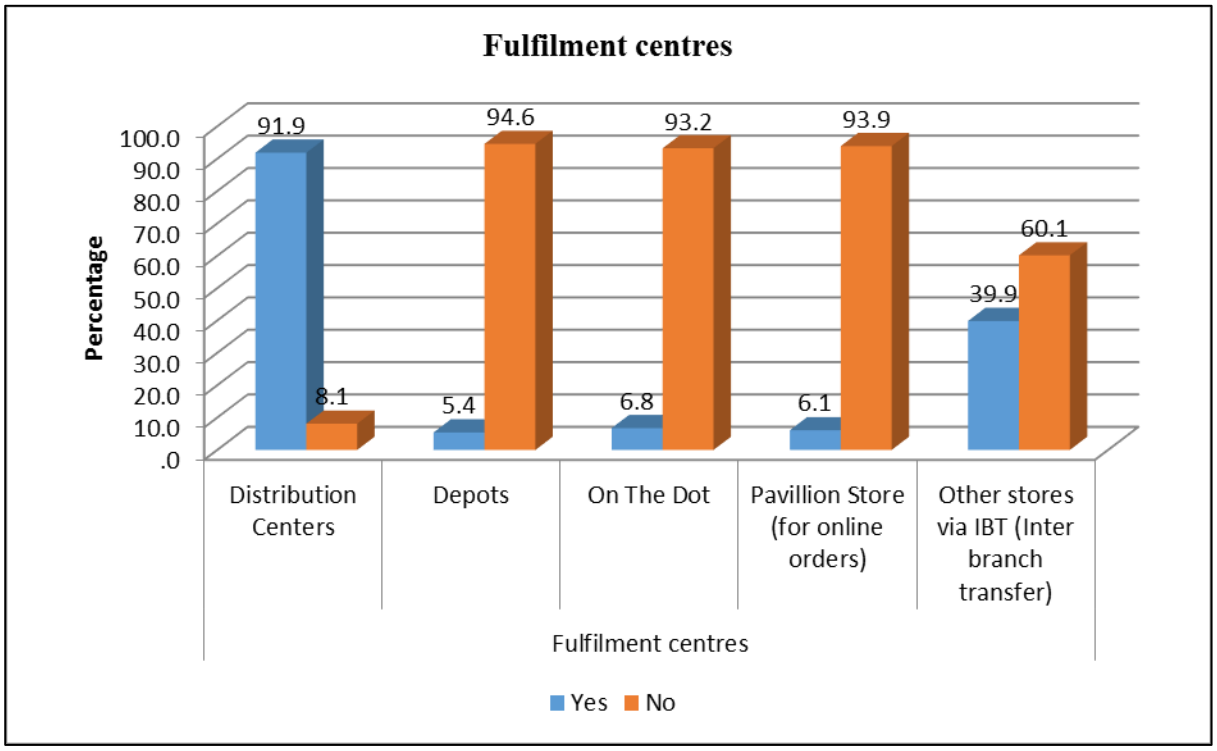
Respondents had to select the purchase channels and pick up method offered by the company to customers. The result is that 79% of respondents elected that the company offers buying online and pick up in store capability whilst a majority, more than 60%, identified that in-store customer order, buy in-store and deliver to a preferred destination and buy in store and pick up from the post office were not being used as purchase channels offered by the company to customers. This is illustrated in the frequency tables section 3.1, table 5 of the appendix.

The Binomial test done is based on the z approximation as depicted in table 4.3 which identified that a significant proportion of respondents indicated that buy online and pick up in-store was a common cross channel offered (79%, $p< 0.025$); while a significant proportion indicated that the alternate cross channels were hardly used: buy in-store and delivered to preferred destination (89%, $p< 0.025$) and buy online and pick up from the post office (82%, $p< 0.025$) whilst buy in-store and pick up in-store resulted in 61% ($p=.011$) which reflects a statistically insignificant relationship. The results are indicative that majority of the cross channel buying is from online purchase and in-store pick up. It appears that majority of the stores are not aware of or not using the other methods of cross channel buying.

Table 5.3: Binomial Test - Cross channel buying

	Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
Buy online_ pickup instore	Yes	117	.79	.50	.000[a]
	No	31	.21		
	Total	148	1.00		
Buys in store and deliver	No	131	.89	.50	.000[a]
	Yes	17	.11		
	Total	148	1.00		
Buys and picks up in store	No	90	.61	.50	.011[a]
	Yes	58	.39		
	Total	148	1.00		
Buys online and pick from post office	Yes	27	.18	.50	.000[a]
	No	121	.82		
	Total	148	1.00		

Figure 5.4: Fulfilment centres



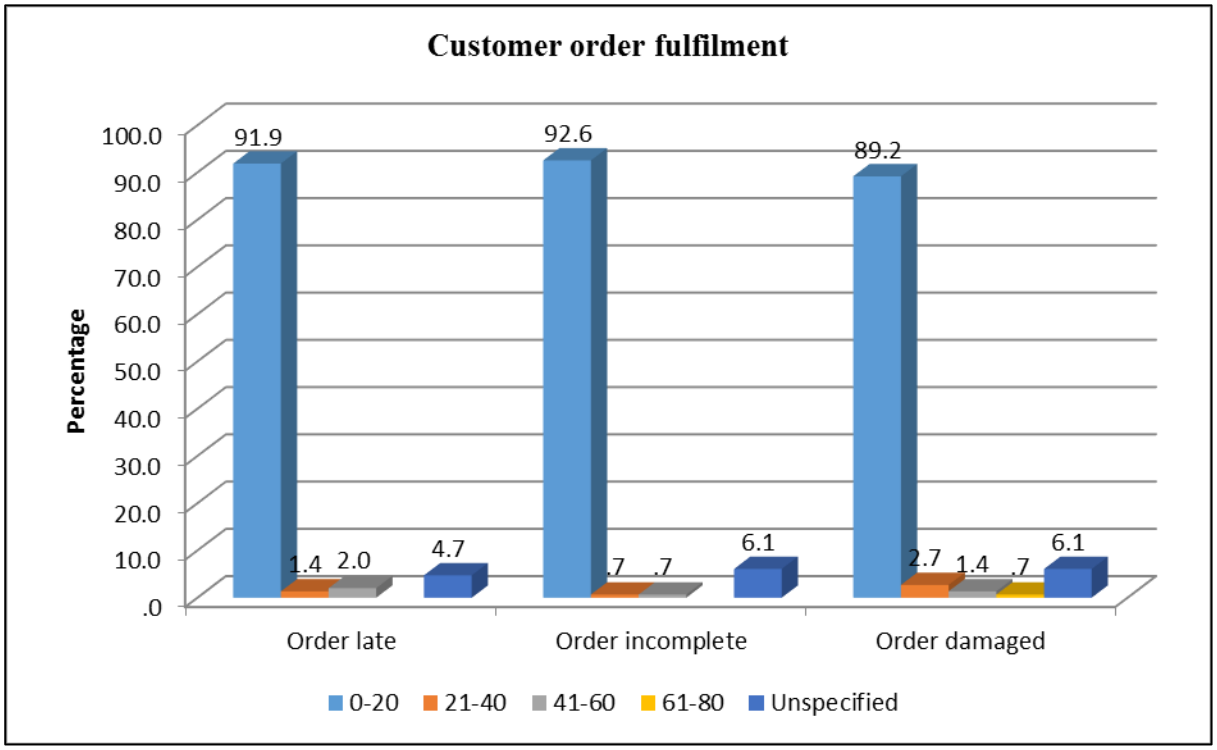
Respondents were requested to select the fulfilment centre that their branch receives stock from. The result indicates that 91.9% of respondents selected the distribution centre as a major fulfilment centre. Whilst the depots, online fulfilment centre and store fulfilment centres represented minor percentage of respondents, inter-branch transfers were the second most commonly selected fulfilment method which comprised 39.9% of the responses.

Binomial test was done based on the z approximation as depicted in table 5.4. A significant proportion indicated that distribution centres were used to fulfil stores (92%, $p< 0.025$); while a significant proportion indicated that the alternate fulfilment centres were hardly used: depots (95%, $p< 0.025$) and online fulfilment centre (93%, $p< 0.025$) whilst store fulfilment centre (60%, $p=.017$) reflected a statistically insignificant relationship. The result reflects that whilst the distribution centre remains a primary fulfilment centre, depot and store fulfilment remain as secondary fulfilment centres.

Table 5.4: Binomial Test – Fulfilment centers

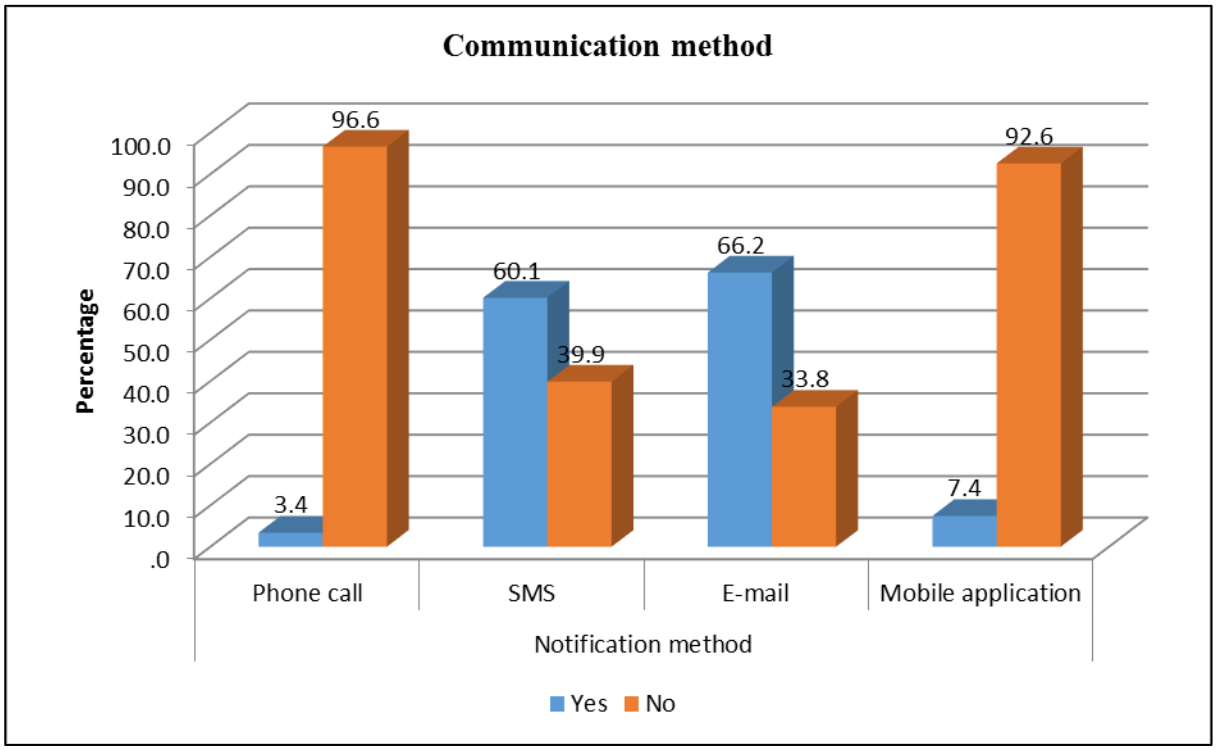
	Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
Distribution Centers	Yes	136	.92	.50	.000[a]
	No	12	.08		
	Total	148	1.00		
Depots	No	140	.95	.50	.000[a]
	Yes	8	.05		
	Total	148	1.00		
On The Dot	No	138	.93	.50	.000[a]
	Yes	10	.07		
	Total	148	1.00		
Pavillion Store (for online orders)	No	139	.94	.50	.000[a]
	Yes	9	.06		
	Total	148	1.00		
Other stores via IBT (Inter branch transfer)	Yes	59	.40	.50	.017[a]
	No	89	.60		
	Total	148	1.00		

Figure 5.5: Customer order fulfilment



Respondents were requested to select how often customers' orders were late, not in full or damaged in the last 6 months given an option of 0-20 instances, 21-40 instances, 41-60 instances and 61-80 instances. Figure 5.5 reflects that majority of the responses for all three metrics fell in the 0-20 option. There were 0-20 instances in the last 6 months that customers' orders were late, incomplete and damaged for 91.9%, 92.6% and 89.2% of the responses respectively. The minority which was below a cumulative of 5% for each metric elected that orders were late, incomplete and damaged in more than 21 instances and less than 7% of the respondents did not specify. The result reflects that whilst majority of the orders are on time, in full and not damaged, order fulfilment is not 100%, particularly in the case of the product condition which is less than 90%.

Figure 5.6: Communication method with customers

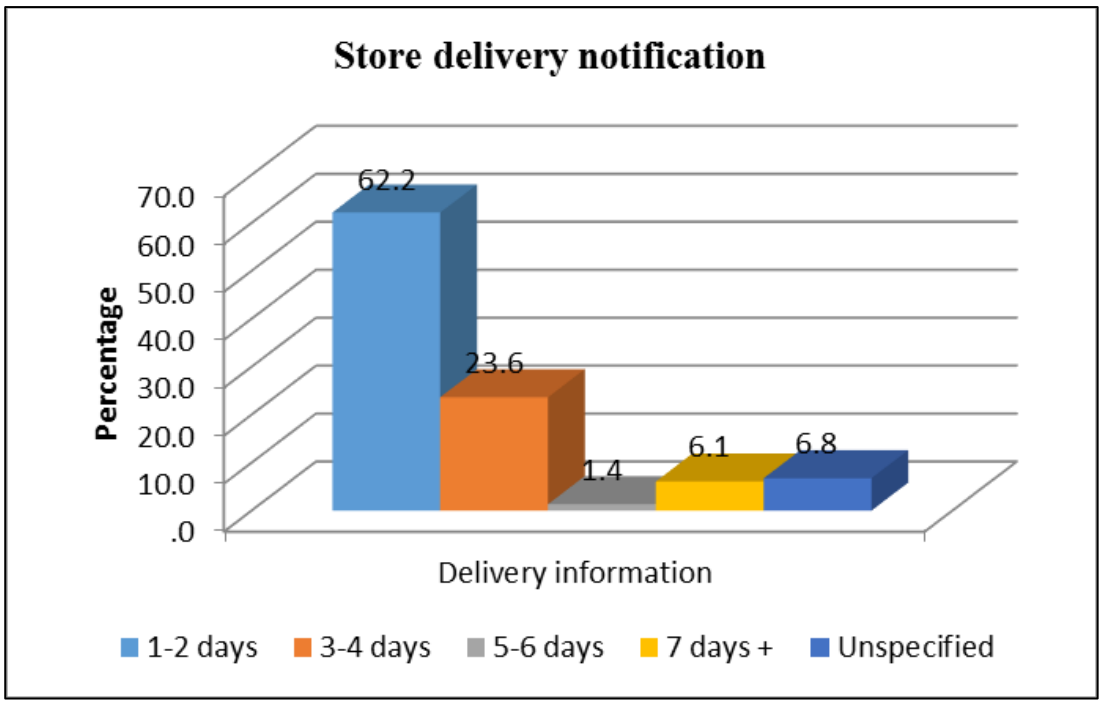


Respondents had to select the communication method used to inform customers that their store delivered order was ready. They were given the options of phone call, short message service (sms), electronic mail (e-mail) and mobile application. Figure 4.6 of the appendix illustrates that 66.2% of respondents selected e-mail, followed by 60.1% of respondents whom selected sms whilst phone call and mobile application was selected by 3.4% and 7.4% of respondents respectively. The results indicate that sms and e-mail serve as a primary methods of communication with the customers concerning their order. Binomial test was done based on the z approximation as depicted in table 5.5. A significant proportion indicated that e-mail was used as method communication (66%, $p< 0.025$); while a significant proportion indicated that the alternate communication methods were not used: phone call (97%, $p< 0.025$) and mobile application (93%, $p< 0.025$) whilst sms (60%, $p=.017$) reflected a statistically insignificant relationship.

Table 5.5: Binomial Test – Communication method

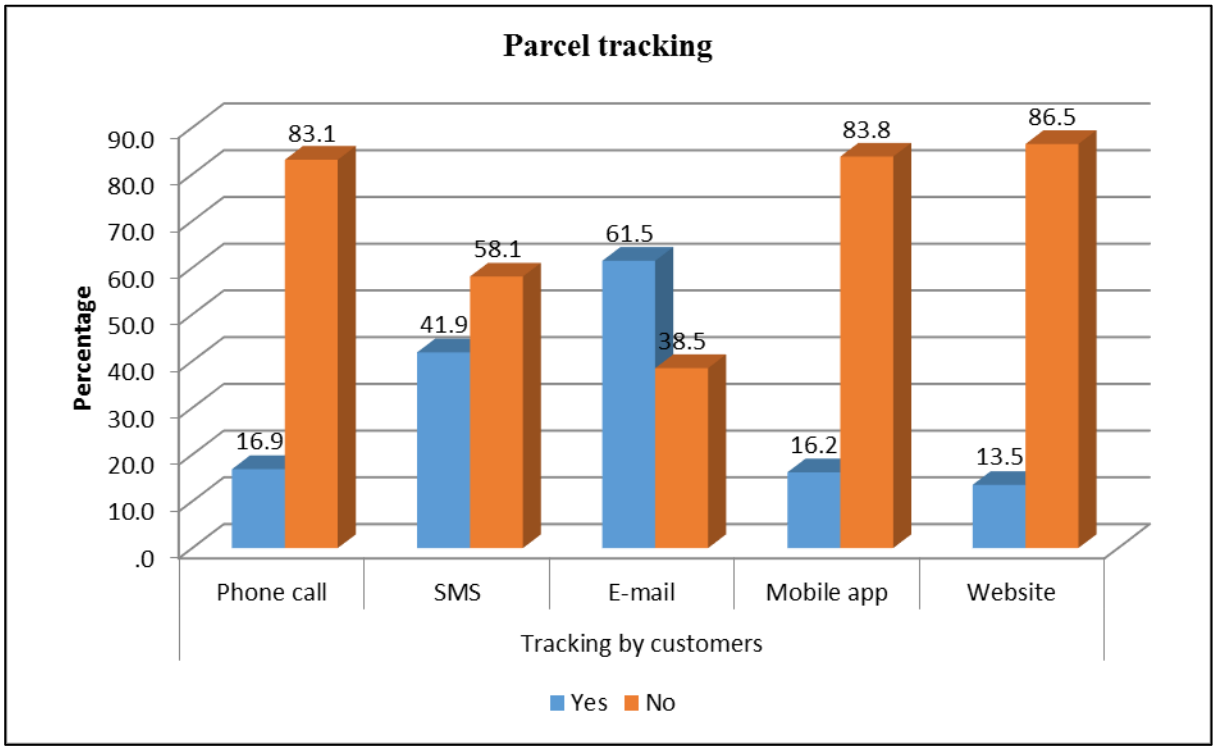
	Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
Phone call	No	143	.97	.50	.000[a]
	Yes	5	.03		
	Total	148	1.00		
SMS	Yes	89	.60	.50	.017[a]
	No	59	.40		
	Total	148	1.00		
E-mail	Yes	98	.66	.50	.000[a]
	No	50	.34		
	Total	148	1.00		
Mobile application	No	137	.93	.50	.000[a]
	Yes	11	.07		
	Total	148	1.00		

Figure 5.7: Store delivery notification



Respondents were to select how many days in advance their branch received notification of the quantity of customers' orders to be received by the store. They were given the option of 1-2 days, 3-4 days, 5-6 days, 7 or more days. Figure 5.7 illustrates that 62.2% of respondents indicate that the store receives notification of the orders 1-2 days in advance whilst 23.6% reflected that their branch received notification within 3-4 days, 1.5% selected 5-6 days, 6.1% selected 7 days or more and 6.8% did not answer. The analysis reveals that whilst almost two thirds of the respondents' branches receive notification between 1-2 days, the remaining respondents that chose to answer receive communication later.

Figure 5.8: Parcel tracking



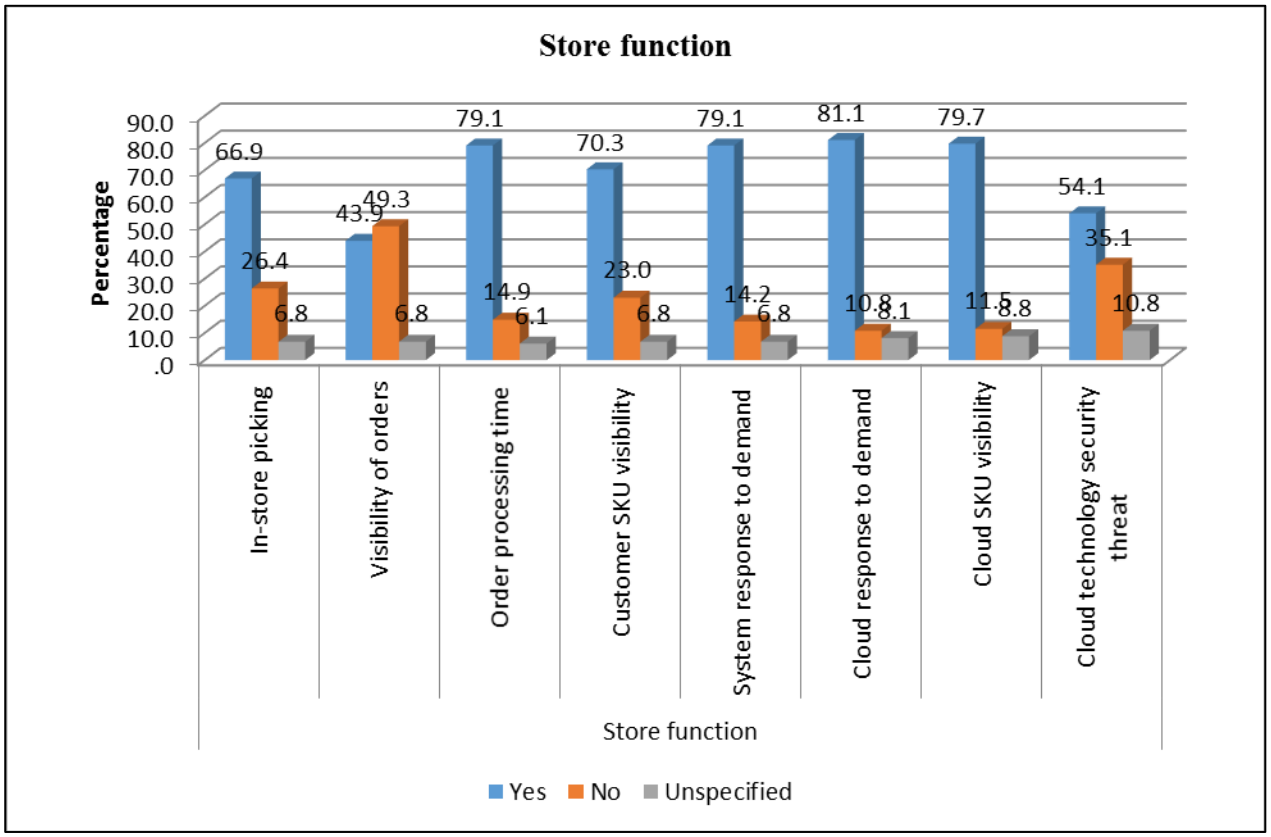
Respondents had to select the most commonly used medium of parcel tracking by customers. Figure 5.8 reveals that 61.5% of the respondents selected e-mail as the most commonly used medium by customers. 41.9% of respondents selected sms , followed by phone call, mobile application and the website which were selected by 16.9%, 16.2% and 13.5% of respondents respectively.

Using the Binomial test, a significant proportion indicated that the alternate tracking methods were not used: phone call (83%, $p< 0.025$), mobile application (84%, $p< 0.025$) and website (14%, $p< 0.025$) whilst e-mail (61%, $p< 0.025$) is a commonly used method. There was no difference in the proportion who used SMS and didn't use SMS to track their order. This result indicates that whilst there are five mediums of parcel tracking, majority of the respondents are of the view that e-mail and sms is most commonly used mediums by customers.

Table 5.6: Binomial Test – Parcel tracking

	Category	**N**	**Observed Prop.**	**Test Prop.**	**Asymp. Sig. (2-tailed)**
Phone call	No	123	.83	.50	.000[a]
	Yes	25	.17		
	Total	148	1.00		
SMS	No	86	.58	.50	.058[a]
	Yes	62	.42		
	Total	148	1.00		
E-mail	Yes	91	.61	.50	.006[a]
	No	57	.39		
	Total	148	1.00		
Mobile app	No	124	.84	.50	.000[a]
	Yes	24	.16		
	Total	148	1.00		
Website	Yes	20	.14	.50	.000[a]
	No	128	.86		
	Total	148	1.00		

Figure: 5.9 Store function



Respondents were asked a multitude of questions in relation to the store operation. The results of their feedback is depicted in figure 5.9. Firstly, they were asked if their branch would be able to successfully undertake the picking function for online and customer orders in addition to their daily functions. 66.9% of the respondents felt that their branch could perform additional picking function whilst 26.4% felt that they could not. Secondly, the respondents were asked if they were made aware of the number of orders they were expected to receive. The result was almost the same between the two options, 43.9% nominated that they had visibility of the order whilst 49.3% nominated no. Thirdly, they were asked if their branch had sufficient time to sort the order before it was due for pick up by the customer. 79.1% identified that their store is able to process the order in time for pick up by the customer whilst 14.9% identified that it is not possible to process the order in time for pick up.

Respondents were thereafter asked if customers have visibility of SKUs online of individual stores. 70.3% responded that customers did have visibility of SKUs within individual stores whilst, 23% responded that customers did not have visibility. In addition, respondents were questioned if the Redworld POS system provides real time visibility of stock movement at SKU level in order to respond to demand.

Approximately 79.1% of the respondents answered that the Redworld POS system does provides real time visibility of SKUs whilst 14.2% answered that it does not. Respondents were thereafter asked if a Cloud based omni-channel enables businesses to respond to demand faster due to greater visibility. 81.1% of the respondents answered that a Cloud based omni-channel does enable businesses to respond to demand faster due to greater visibility whilst 10.8% responded that it does not. Respondents were further asked if a Cloud based omni-channel provides real time information visibility and processing agility. 79.9% of the respondents answered that a Cloud based omni-channel provides real time information visibility and processing agility whilst 11.5% answered that it does not. Respondents were lastly asked if Cloud technology poses a security threat in an omni-channel supply chain. 54.1% nominated that it does pose a security threat whilst 35.1% identified that it does not pose a security threat.

Based on the Binomial a significant proportion indicated that in-store picking can be performed in addition to other functions (72%, $p< 0.025$). Visibility of customer and online orders did not render a distinct result (47%, $p>0.025$) indicating that the probability of the result may be due to chance. A significant proportion indicated that the store had sufficient time to process online and customers' orders (84%, $p< 0.025$). A significant proportion indicated that customers have SKU visibility online of stock in-store (75%, $p< 0.025$). A significant proportion indicated that Redworld POS provides SKU visibility to respond to demand (85%, $p< 0.025$). A significant proportion indicated that Cloud technology provides greater visibility to respond to demand faster (88%, $p< 0.025$). A significant proportion indicated that cloud technology provides real time visibility and processing agility (87%, $p< 0.025$) whilst the views on cloud technology posing a security threat rendered a result of (61%, $p>0.025$) indicating that there may be a relationship but it cannot be concluded with certainty.

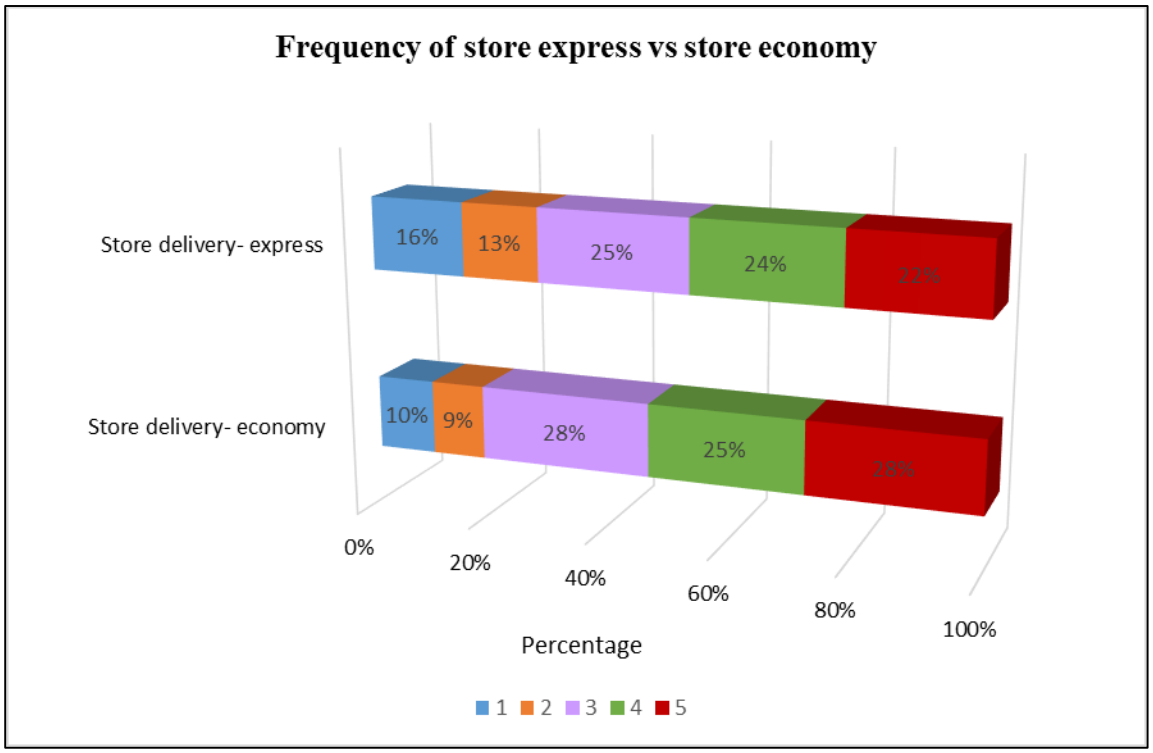
Table 5.7: Binomial Test – Store function

	Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
Store function-In-store picking	Yes	99	.72	.50	.000[a]
	No	39	.28		
	Total	138	1.00		
Store function-Visibility of orders	Yes	65	.47	.50	.551[a]
	No	73	.53		
	Total	138	1.00		
Store function-order processing time	No	22	.16	.50	.000[a]
	Yes	117	.84		
	Total	139	1.00		
Store function-Customer SKU visibility	Yes	104	.75	.50	.000[a]
	No	34	.25		
	Total	138	1.00		
Store function-System response to demand	Yes	117	.85	.50	.000[a]
	No	21	.15		
	Total	138	1.00		
Store function-Cloud response to demand	Yes	120	.88	.50	.000[a]
	No	16	.12		
	Total	136	1.00		
Store function-Cloud SKU visibility	Yes	118	.87	.50	.000[a]
	No	17	.13		
	Total	135	1.00		
Store function-Cloud technology security threat	Yes	80	.61	.50	.018[a]
	No	52	.39		
	Total	132	1.00		

The majority of the store management are of the view that in-store picking can be conducted in-store amongst other store functions that are performed and that there is sufficient time to process the order in time for pick up by the customer. However, there is no distinct and comprehensive conclusion concerning store visibility of online and customer orders. This finding is indicative that the store operation can be used in the last mile in the supply chain to facilitate order pick up.

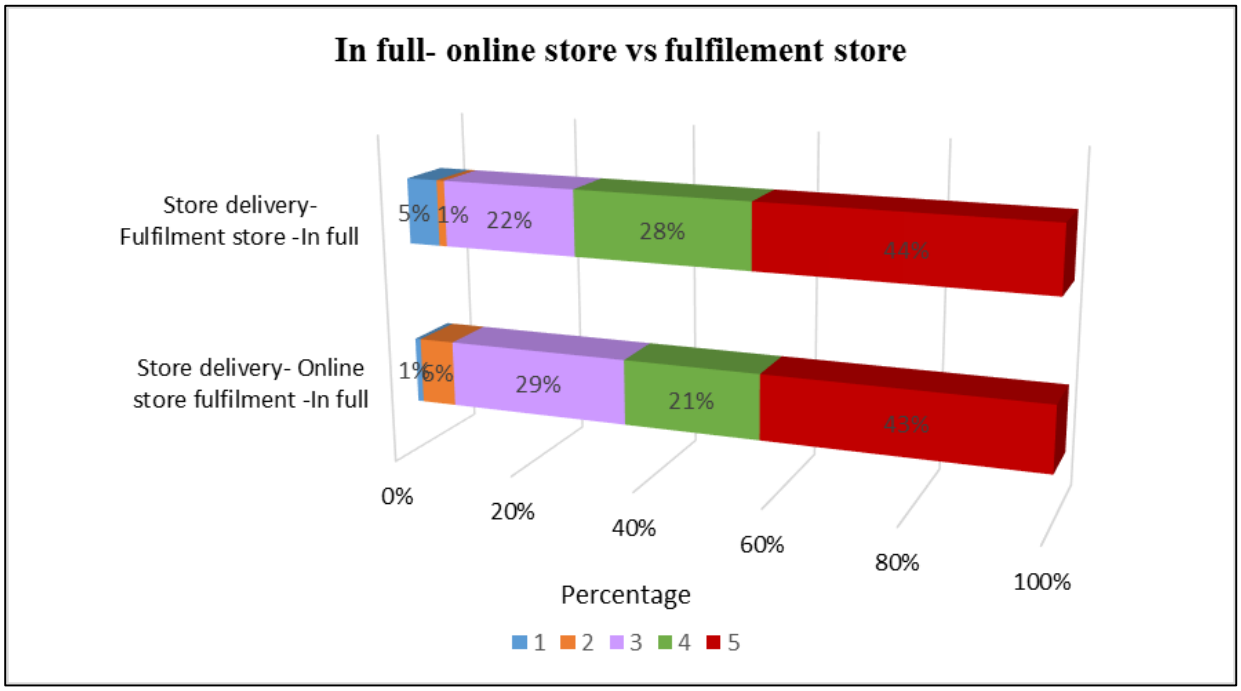
The respondents identified that although the store and customers have visibility of SKUs with the Redworld POS system, a cloud based omni-channel provides real time information visibility and processing agility which can respond to demand faster. However, despite the benefits of cloud technology, the majority of the respondents felt that it posed a security threat.

Figure 5.10: Store delivery- via store economy and store express



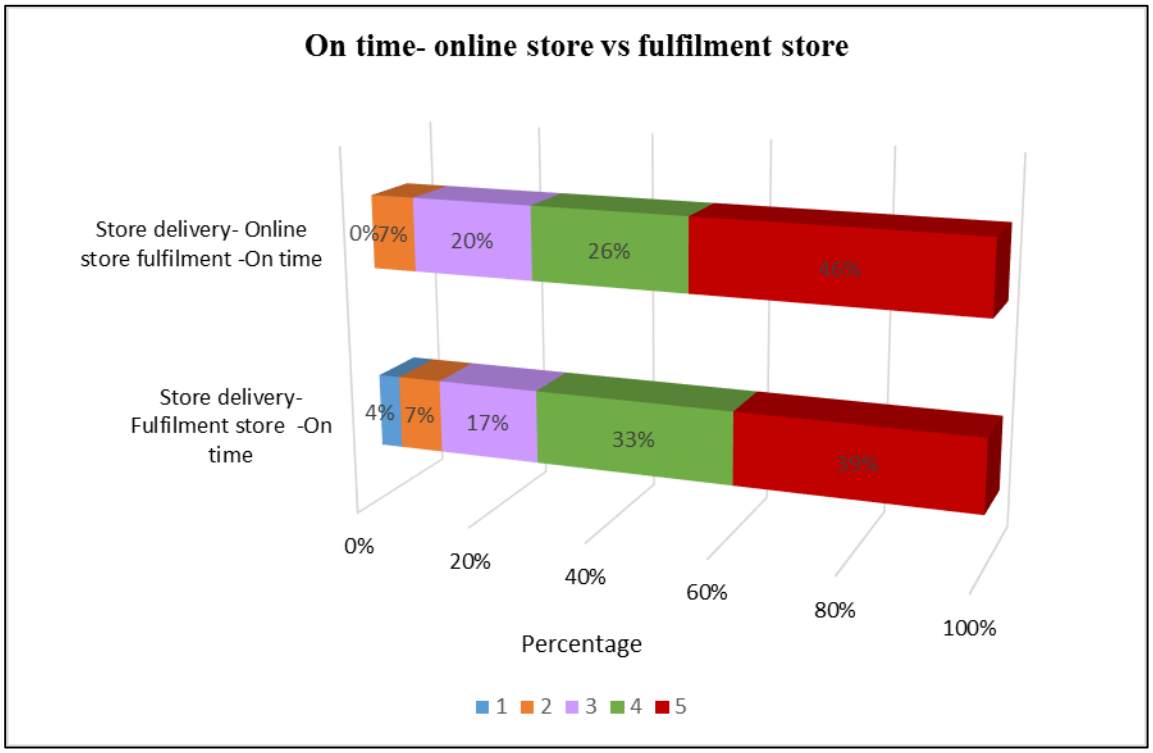
Respondents were asked to rate the frequency and effectiveness of the system to fulfil customers' orders. They were given a 5 point comparative scale. For questions 28 and 29 they were to rate the frequency which orders were delivered via store economy and store express to their branch respectively. Retailer X offers four types of delivery to the customer, door to door, store express, store economy and delivery via the postal system. In questions 28 and 29, 1 denoted a low frequency and 5 denoted a high frequency. Figure 5.10 illustrates that 81% of the respondents selected 3-5 for question 28 which indicates that the frequency of store economy being used is moderate to high. 71% of the respondents selected 3-5 for question 29 which indicates that the frequency of store express being used is moderate to high.

Figure 5.11: Store delivery- In full fulfilment via the online store and fulfilment stores



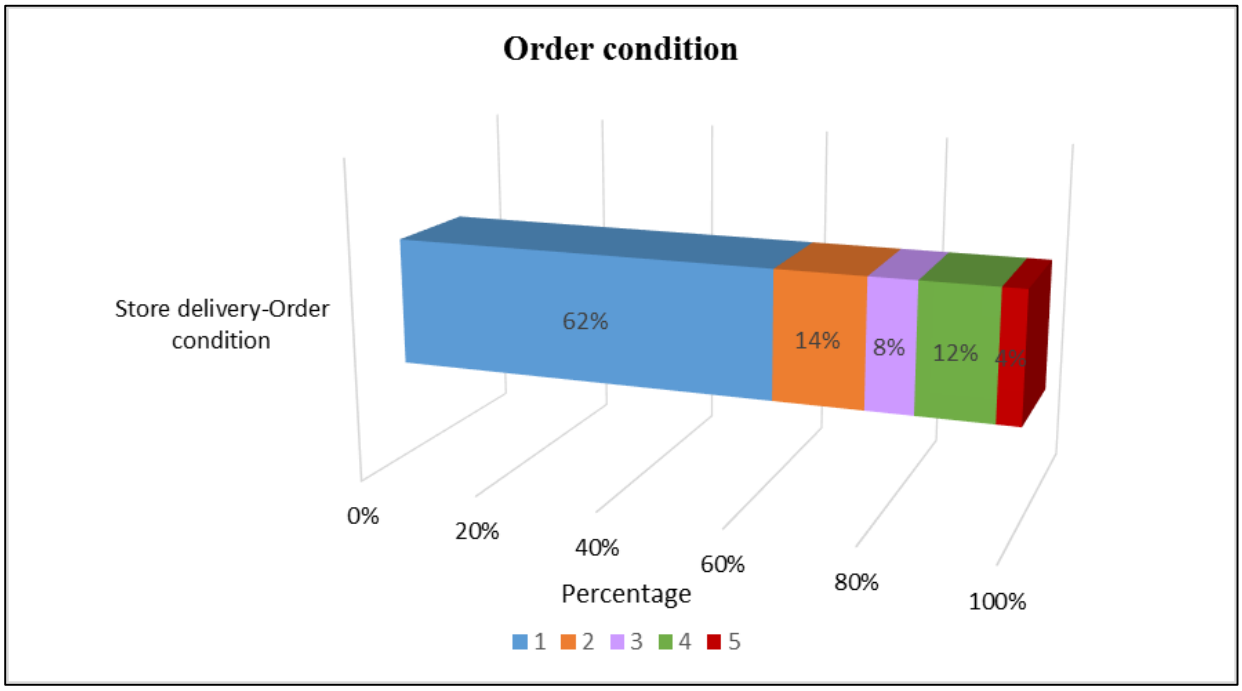
The online store operates like a small scale distribution centre (DC) for online orders only. Whilst, the fulfilment stores is a brick and mortar which serviced out of the traditional network. Stores are serviced by either the online or replenishment store or in some cases by both. In questions 30 and 32 respondents were to rate how effective the online store is fulfilling orders in full using a 5 point comparative scale. 1 denoted extremely ineffective and 5 denoted extremely effective. Figure 5.11 illustrates that 64% of responses rated that the online store as being effective to highly effective at fulfilling all online orders in full whilst 72% of responses rated that the fulfilment store as being effective to highly effectively at fulfilling all online orders in full. The results indicate that the fulfilment store was rated by a greater percentage of respondents as being effective to highly effective at fulfilling orders in full.

Figure 5.12: Store delivery- On time fulfilment via the online store and fulfilment stores



In questions 31 and 33 respondents were to rate how effective the online and fulfilment stores are at fulfilling online on time using a 5 point comparative scale. 1 denoted extremely ineffective and 5 denoted extremely effective. 72% of the respondents rated the online store and fulfilment as being effective to extremely effective at fulfilling order on time.

Figure 5.13: Store delivery- order condition



In question 34 respondents were to rate the condition of the order when it is received into the branch using a 5 point comparative scale. 1 denoted extremely good condition and 5 denoted extremely bad condition. Figure 5.13 and section 3.1, table 15 of the appendix illustrates that 76% of the respondents selected that product condition is in good to extremely good condition.

Figure 5.14: Omni-distribution system

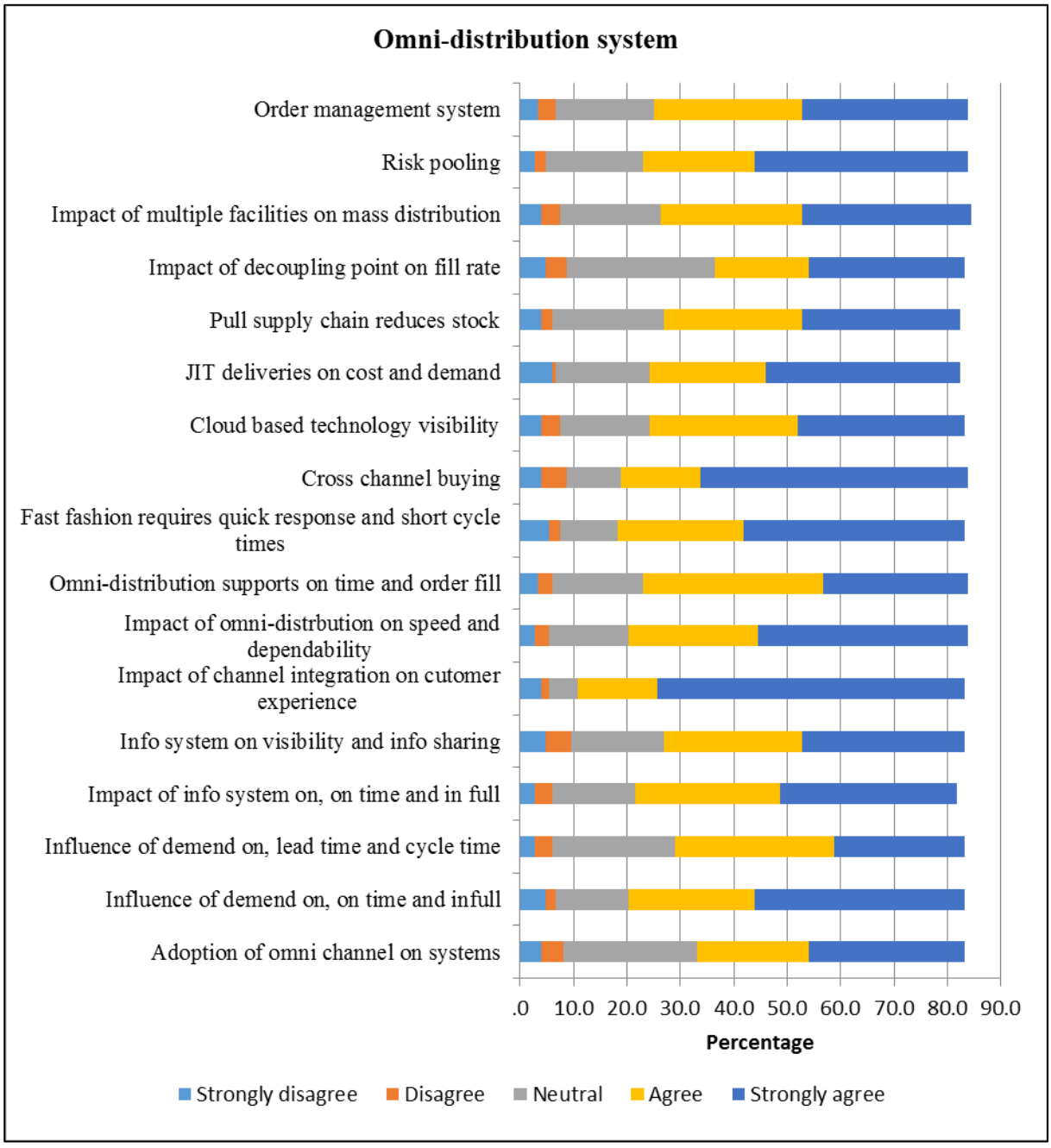


Figure 5.14 depicts that the adoption of many retail channels influences the supply chain retail distribution system (60.2%). The result indicates that 75.7% of the respondents underpins the magnitude of customer demand as having an influence on 'in full' and 'on time' order fulfilment in the overall distribution system. The change in demand shows an influence on fulfilment lead time and cycle time in the distribution network (65.1%).

An integrated information systems improves in full and on time order fulfilment (73.6%) by enhancing information sharing and visibility within the virtual distribution network (67.7%). Channels need to therefore become integrated to provide an excellent customer experience (87%). The omni-channel distribution network enhances the logistics customer service on speed and dependability (77.8%) and supports order fulfilment through on time delivery and order fill rate (72.6%). Respondents (78.1%) agree that the fast fashion retailing channels require agile supply chains with quick response strategy and shorter cycle times. The respondents (77.4%) indicates that the company has adapted its distribution network for cross channel buying to fulfil the needs of customers. The omni-distribution system is aimed to pull supply chain activities from demand driven orders to reduce system inventory (67.2%) with the use of cloud based technology providing visibility of detailed data in real-time, from various sources across the chain (70.7%) and by delivering stock in small frequent loads 'Just in time' to improve response to changes in demand (70.5%). However, when demand is unknown, the supply chain can be decoupled to respond to demand in full by forecasting orders until stock reaches distribution and then distributing stock based on known demand (56.1%) by pulling supply chain activities in the omni-distribution system (67.2%).The use of a main distribution center and multiple smaller distribution facilities benefits mass distribution (68.8%). Notably, 72.6% of the respondents agree that online channels provide broader product assortment to customers whilst reducing the risk due to risk pooling. Order Management System unifies order processing across the retailer's distribution network of physical stores (70.2%).

5.1.1.2 Descriptive Statistics

The standard deviation measures the variability in data by calculating the square root of the difference in the mean and observation in interval and ration scaled data (Lewis *et al.,* 2009:318). The mean, standard deviation and t-test statistic is being used to analyse questions 28-34 and question 35 of the survey instrument.

Table 5.8: Store delivery- mean, standard deviation and t-test

One-Sample Statistics and Tests (Test Value = 3)							
	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Store delivery- OTD on time	108	4.11	0.98	0.094	11.79	107	0.00
Store delivery- Pavilion in full	79	4.05	1.085	0.122	8.608	78	0.00
Store delivery- OTD in full	107	4.00	1.019	0.098	10.15	106	0.00
Store delivery- Pavilion on time	82	3.96	1.094	0.121	7.977	81	0.00
Store delivery- economy	134	3.52	1.255	0.108	4.819	133	0.00
Store delivery- express	132	3.23	1.358	0.118	1.986	131	0.05
Store delivery-Order condition	133	1.80	1.221	0.106	-11.28	132	0.00

The mean value for store delivery via economy of 3.52 is > 3 and significantly different from a neutral value of 3. Orders are delivered via store economy with a significantly higher frequency ($t(133) = 4.819$, $p< 0.025$). The mean value of store delivery via express of 3.23 is > 3 and moderately different from a neutral value of 3. Orders are delivered via store express are significant ($t(131) = 1.986$, $p>0.025$). The result indicates that although store economy and store express are being used frequently, store economy is being used more frequently than store express but this finding cannot be confirmed with certainty since p is greater than 0.025.

The mean value of orders being delivered in full to the online store is 4 which is > 3 and significantly different from a neutral value of 3. The online store is effective at delivering orders in full ($t(107) = 10.154$, $p<0.025$). The mean value of orders being delivered on time to the online store is 4.11 which is > 3 and significantly different from a neutral value of 3. The online store is effective at delivering orders on time ($t(106) = 11.788$, $p<0.025$). The mean value of orders being delivered in full to the fulfilment store is 4.05 which is > 3 and significantly different from a neutral value of 3. The fulfilment store are effective at delivering orders in full ($t(78) = 8.608$, $p<0.025$). The mean value of orders being delivered on time to the fulfilment store is 3.96 which is > 3 and significantly different from a neutral value of 3. The fulfilment stores are effective at delivering orders on time ($t(81) = 7.977$, $p<0.025$). The mean value of order condition for stock delivered to the online and replenishment stores is 1.80 which is < 3 and significantly different from a neutral value of 3.

Although the frequency is significantly lower, ($t(132) = -11.288$, $p<0.025$) which reflects that the condition of the order is good. The result of the t-test in table 5.9 establishes that $p<0.025$ for all statements hence there is a very significant level of agreement.

Table 5.9: Omni-distribution system- mean, standard deviation and t-test

One-Sample Statistics and Test (Test Value = 3)						
	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Impact of channel integration on customer experience	123	4.45	1.034	15.524	122	0
Cross channel buying	124	4.22	1.159	11.704	123	0
Impact of omni-distribution on speed and dependability	124	4.13	1.028	12.232	123	0
Fast fashion requires quick response and short cycle times	123	4.12	1.142	10.894	122	0
Risk pooling	124	4.11	1.038	11.944	123	0
Influence of demand on, on time and in full	123	4.09	1.116	10.824	122	0
Impact of info system on, on time and in full	121	4.03	1.032	11.008	120	0
JIT deliveries on cost and demand	122	3.99	1.168	9.381	121	0
Order management system	124	3.95	1.058	10.015	123	0
Omni-distribution supports on time and order fill	124	3.94	1.01	10.313	123	0
Cloud based technology visibility	123	3.94	1.089	9.607	122	0
Impact of multiple facilities on mass distribution	125	3.93	1.094	9.486	124	0
Pull supply chain reduces stock	122	3.91	1.076	9.342	121	0
Info system on visibility and info sharing	123	3.87	1.145	8.427	122	0
Influence of demand on, lead time and cycle time	123	3.84	1.003	9.259	122	0
Adoption of omni channel on systems	123	3.8	1.121	7.963	122	0
Impact of decoupling point on fill rate	123	3.75	1.157	7.173	122	0

5.1.1.3 Hypothesis testing

Levene's test, t -test and Chi square will be used. Levene's test is used to test the equality of variances amongst independent groups (Starkweather, 2010). Chi square value was established by calculating the chi square value of both variables and the associated level of statistical significance (Rowley, 2014:325). The test requires the categories to be mutually exclusive. If the result presents a large value and ($p<0.05$), then there is association between variables. In contrast, if the results presents a small value and ($p>0.025$), then there is no association between the variables (Diener-West, 2008:15).

a. <u>Sales and the adoption of multiple channels</u>

Table 5.10: Sales and the adoption of multiple channels

Adoption Levels	Observed N	Expected N	Residual
Increased	89	47.7	41.3
Decreased	21	47.7	-26.7
Remained unchanged	33	47.7	-14.7
Test Statistics			
Chi-Square			55.273[a]
Df			2
Asymp. Sig.			.000

The impact of having adopted multiple channels on sales was tested as depicted in table 5.10. H_{10}, the adoption of multiple channels does not increase sales. H_{1A}, the adoption of multiple channels does increase sales. Table 5.10 depicts that majority of the respondents found that store sales increased due to the extension to online channels. The findings of the Chi square test are that a significant number of respondents indicated that sales have increased (χ^2 (2) = 55.273, $p<$. 0.05). The null hypothesis is therefore rejected. There is an association between adoption of multiple channels and sales.

b. Cross channel fulfilment- Fulfilment channels

Table 5.11: Group Statistics

	Single/Multilpe	N	Mean	Std. Deviation	Std. Error Mean
number channels	Single channel	90	1.51	1.073	0.113
	Multiple channels	51	3.29	1.77	0.248

Table 5.12: Independent sample test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
number channels	Equal variances assumed	27.108	0	-7.451	139	0	-1.783	0.239	-2.256	-1.31
	Equal variances not assumed			-6.546	71.269	0	-1.783	0.272	-2.326	-1.24

The effect of the adoption of multiple purchase channels on the assortment of channels fulfilled by the store was tested using Lavene's test and t-test to test equality of variances amongst two independent groups. The equality of stores that fulfil a single channel vs multiple channels will be tested. H_{20} The adoption of multiple purchase channels has no influence on the assortment of channels fulfilled by stores. H_{2A} The adoption of multiple purchase channels increases the assortment of channels fulfilled by stores.

A two tailed test has been conducted with a 95% confidence level. The average number of channels fulfilled by stores is significantly larger for those stores that identified that the company offers multiple purchase channels (3.29) than those that identified that the company adopts single purchase channels (1.51), t(71.269) = -6.546, $p < 0.025$). Equal variance is not assumed. The result indicates that stores which nominated that the company offers multiple purchase channels, are fulfilling more channels compared to stores that indicated that the company offers few purchase channels. The null hypothesis is therefore rejected. The adoption of multiple purchase channels increases the assortment of channels fulfilled by stores.

c. Cross channel fulfilment- Fulfilment centres

Table 5.13: Group Statistics

Single/Multilpe		N	Mean	Std. Deviation	Std. Error Mean
number fulfilment centres	Single channel	90	1.22	0.536	0.056
	Multiple channels	51	2.14	0.8	0.112

Table 5.14: Independence sample test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
number fulfillment centres	Equal variances assumed	7.407	0.007	-8.111	139	0	-0.915	0.113	-1.138	-0.692
	Equal variances not assumed			-7.29	75.869	0	-0.915	0.126	-1.165	-0.665

The impact of having adopted multiple retail channels on the assortment of fulfilment centres was tested using Lavene's test and t-test to test equality of variances amongst two independent groups. The equality of stores that were fulfilled from a single fulfilment centre vs multiple fulfilment centres will be tested in relation to the number of channels the store fulfilled. H_{30} The adoption of multiple purchase channels does not require an assortment of fulfilment centres. H_{3A} The adoption of multiple purchase channels requires an assortment of fulfilment centres.

A two tailed test was conducted with a 95% confidence level as illustrated in section 2.1.3, table 23 of the appendix. The assortment of fulfilment centres is significantly larger for those stores that fulfil multiple channels (2.14) than those that fulfil a single channel (1.22), $t(75.869) = -7.290$, $p<0.025$). Equal variance is not assumed. The result indicates that stores which fulfil more channels have an assortment of fulfilment centres.

d. Customer order fulfilment

Table 5.15: Customer order fulfilment

	Customer order- On time					Customer order- In Full					Customer order- Damage			
	Category	Observed N	Expected N	Residual		Category	Observed N	Expected N	Residual		Category	Observed N	Expected N	Residual
1	0-20	136	35.3	100.8	1	0-20	137	34.8	102.3	1	0-20	132	34.8	97.3
2	21-40	2	35.3	-33.3	2	21-40	1	34.8	-33.8	2	21-40	4	34.8	-30.8
3	41-60	3	35.3	-32.3	3	41-60	1	34.8	-33.8	3	41-60	2	34.8	-32.8
4		0	35.3	-35.3	4		0	34.8	-34.8	4	61-80	1	34.8	-33.8
Total		141			Total		139			Total		139		

Test Statistics

	Customer order- On time	Customer order- In Full	Customer order- Damage
Chi-Square	384.078[a]	401.173[b]	363.014[b]
df	3	3	3
Asymp. Sig.	0	0	0

The effect of using store deliveries in the last mile on customer order fulfilment metrics of on time, in full deliveries as well as order condition was tested using the Chi square test. For on time deliveries, H_{40} Store delivery encounters more than 21 instances where the order was late. H_{4A} The store delivery encounters less than 21 instances where the order is late. For in full deliveries, H_{50} Store delivery encounters more than 21 instances where the order was not in full. $H_{5A,}$ Store delivery encounters less than 21 instances where the order is not in full. For order condition, H_{60} Store delivery encounters more than 21 instances where the order was damaged. H_{6A} Store delivery encounters less than 21 instances where the order is damaged.

Figure 5.15 illustrates that 89% of the respondents found that there were 0-20 instances where the order was late, not in full or damaged in the last 6 months of the study as opposed to 21-60 instances. The findings of the Chi square test are that a significant number of respondents indicated that there were 0-20 instances in the last 6 months that: the order was late (χ^2 (2) = 384.08, p<0.05), the order was not in full (χ^2 (2) = 401.17, p<0.05) and the order was damaged (χ^2 (2) = 363.01, p<0.05). The null hypothesis is therefore rejected for all three metrics. There is an association between store deliveries and customer order fulfilment.

e. Store delivery notification

Table 5.16: Store delivery notification

	Customer order- notice			
	Category	Observed N	Expected N	Residual
1	1-2 days	92	34.5	57.5
2	3-4 days	35	34.5	0.5
3	5-6 days	2	34.5	-32.5
4	7 days +	9	34.5	-25.5
Total		138		

Table 5.17: Test Statistic

	Customer order- notice
Chi-Square	145.304[a]
df	3
Asymp. Sig.	0

The duration between the date the store was informed of delivery of the customer order and the date order was delivered needs to be established. Prior notification puts the store in a position to plan its operations. H_{70}, the store is made aware of the delivery more than two days in advance. H_{7A}, the store is made aware within 1-2 days. Figure 5.17 illustrates that majority of the respondents found that more than 62.2% identified that their store received communication of customer's orders being delivered within 1-2 days. The findings of the Chi square test are that a significant number of respondents indicated that notification was received with 1- 2 days (χ^2 (2) = 145.3, $p<0.05$. The null hypothesis is therefore rejected. The analysis indicate that the extension to online channels have increased sales.

The extension to online buying and adoption of cross channel buying is supported by the proliferation of store functions from operating as brick and mortar to a last mile supply chain for online and customers' orders. Although the online and fulfilment stores were rated as being effective to highly effective at fulfilling customers' order in full and delivering on time with the order in good condition, there is approximately 10% failure on order fulfilment which presents an opportunity for improvement.

5.2 Qualitative Approach to the study- Interviews

The study adopts a development mixed method approach which is sequential and equally weighted whereby the findings of the survey inform the questions in the interviews rather than confirming findings of the first approach. Although the survey and data report yielded valuable information through the use of quantitative analysis, interviews are necessary to enhance the quality of the research by explaining the cause of phenomena through depth and flexibility of the semi-structured interview schedule. The categorisation and summarisation of data is utilised to explore the contribution of each department towards fulfilling customers' orders on time and in full. The interviews were transcribed from the audio recordings, categorised and summarised thereafter based on the research objectives.

5.2.1 Omni-channel retailing

Majority of the respondents are of the view that omni-channel retailing has gained momentum in the South African retailer industry. Two of the respondents added that the rate of growth across various channels has increased for local retailers but not to the same extent as international retailers. There has been a conversion of existing shoppers who now shop via online channels rather than at the brick and mortar due to a need for convenience of a greater assortment which is available online. The 3PL elaborates that some retailers have adopted it aggressively whilst some have not done it at all. There are multiple views concerning omni channel in the South African retail industry, whereby some South African retailers have not adopted omni-channel retailing, as others migrated to online fulfilment. The respondents allude to South Africa fast moving consumer goods and apparel retailers as showing considerable interest in using an omni-channel approach. *The systems exposes the retailer's stock and there is currently a lack of visibility of stock in real time which poses a challenge. Stock accuracy in store hasn't been a key driver in South African retail since retailers are still following a push processes in comparison to similar retailers in the rest of the world*. The respondent argues that retailers do not appear ready to adopt the omni-channel approach without spending a lot to make improvements in the network. The company in case is using omni-distribution to save cost and be one of the top performing retailers. There is a realised spin off from buying online and collecting in-store.

E-com is increasing store sales as customers collect online orders in store and purchases more whilst in store. There is extra market share from the same customer. Click and collect baskets are larger than traditional store baskets and bricks are dependent on the clicks now.

Respondents were thereafter asked to elaborate on how the company has utilized omni-channel retailing for its benefit given the current economic climate. "***South Africa is in a pennywise, cost aware climate and Retailer X has tried to manage the cost to keep it lean by offering various cost options to the customer based on lead days; express option, economy option for delivery to store over a longer period rather than only offering the door to door delivery method".*** The exclusion of free delivery is a barrier in moving to the check-out button online as the delivery cost is subsidised but is not free. Lean fulfilment and delivery costs can be passed on to customers. The difference between this company and another local competitor, is that the local competitor has two central locations in Johannesburg and Cape Town. The company has a central online channel in JHB and regional store fulfilment in Cape Town and Durban of which the business is trying to grow the store to minimise costs. Furthermore, data mining is necessary to be more proficient at building assortments as well as timing of the arrival of purchase orders to optimize stock levels in the supply chain to meet customer demand.

Respondents were thereafter asked how the company had to adapt its omni-distribution strategy to suit the local market in respect of order processing and delivery. ***The South African landscape is less dense and more rural with more distance to travel between points which results in higher transport costs and remains questionable as to whether door to door deliveries is viable for the business. Many retailers are moving to multistore fulfilment capacity which put a big emphasis on understanding omni-channel global capacity.*** International retailers have progressed with click and collect due to the delivery process being much more mature. A lot of European retailers closed stores but had to open collection points as customers were not always at home for door to door deliveries to work successfully. The omni-channel has opened the option of deliveries to outlying areas. *South African retailers have not worked well on click and collect but it would suit the South African terrain if the retailer could partner with a local petrol station, spaza grocery or airtime shop, where post boxes are used to drop off orders. As rule, the business does not permit delivery to hotspots in the country as courier vehicles are inclined to hijackings. Customers are provided with the option of collection from the post office or stores or pay for the delivery via door to door if the route is permitted and if the customer is willing to pay for the delivery cost. Drop shipment by vendor to the online store is also not being considered as needs to be a scalable operation. 55% of stock is sourced internationally and 80% of the online business comprises fashion products, as a result drop shipment of fashion items would be very erratic*.

Respondents were asked if Retailer X is geared to compete with global retailers. ***As a South African retailer, the business is still growing the global brand and are building international supply chains for omni-channel retailing to cope with long lead times.*** The network is cost competitive against international and local retailers in South Africa and within Africa. Well established international brands are capturing market share despite being a higher niche retailer. One of the international competitor's service model is built on faster fulfilment and are specific about what stock they want to send to the specific store on a specific day. Their traditional business model is closely aligned with omni-channel high availability model as they strategize on 80% replenishment and 20% stock. By 7am, the courier delivers to all of the competitors stores based on sales from the previous day. They are using a pull-push model because the store managers liaise with planning. Well established international apparel retailers are using store fulfilment which are brick and mortar driven. Omni-channel is not part of their strategy in South Africa; rather they seek to attain a brick and mortar presence. Two of the popular international apparel retailers currently have 7 or 8 stores in the country. Globally, they are better geared to compete compared to Retailer X because their stock accuracy and order fulfilment has been key drivers in their business model and their entire supply chain is geared around demand. International retailers absorbs the cost of delivery since their costs are higher and they focus on the ease of delivery. Retailer X is still learning about global fulfilment as with the expansion to Australia. Direct fulfilment from China to destinations using consolidation centres is an option in the long term. The business currently fulfils global e-commerce from Gauteng, but it plans to leverage countries where there is a store presence. If there isn't a store presence, delivery to international customers will continue via expedited mail system (EMS) for economy orders or courier companies for door to door deliveries.

5.2.2 The effects of omni-channel retail adoption on supply chain retail distribution systems

5.2.2.1 Retail distribution systems

A centralized distribution centre will always be used but near source fulfilment for e-com using stores as a fulfilment centre is an advancement on the traditional model. This model offers speed to delivery for same day or next day delivery of orders. The use of fulfilment stores, spreads the stock across the network based demand. The centralized fulfilment centre would function like a distribution centre rather than as a massive warehouse due to the stock being distributed across the network to fulfilment stores based on demand. The assortment will be different in each store but is dependent on centralized distribution. A respondent alludes that a well-established FMCG retailer chose to only utilize store fulfilment in South Africa. However, a pure store fulfilment model segregates the network. If store fulfilment is only used, it will be difficult to only manage inventory in the business by using stock in stores.

5.2.2.2 Risk pooling

Some of the respondents were asked to explain if the distribution network was achieving risk pooling. ***Stock levels are managed more efficiently in a centralized facility as opposed to a decentralized facility due to existence of risk pooling in a central facility.*** Furthermore, the excessive costs accompanied with a decentralized facility is negated in a centralized facility through risk pooling. The planner and allocator establish what quantities of SKU's need to be available in the DC and stock is allocated from the DC based on demand. Stock aging in the post locations is monitored against the pick, whereby old stock is flushed out of the DC to stores. The centralized model has the capability of reducing the stock holding in the network. If there are many nodes in the network then the business would have to hold stock across the network.

5.2.3 The influence of demand on distribution systems in enhancing the order fulfilment lead time, cycle time and fill rate

5.2.3.1 The push-pull theory and the bullwhip effect

The timing of inventory throughput is dependent on the anticipatory and reactive model being used by the company to match supply to demand based on seasonality and historic trend. The forecast portion of the order delivered to the DC by the supplier is assigned to prepacks by size curve based on what a store is expected to sell. Prepacks are cross docked immediately for dispatch to stores. The balance of the stock is delivered as solids in single SKU cases to be picked for stores based on store sales. Once true demand is known, replenishment is only based on demand. *The DC unit picks or full case picks to stores based on true demand in the prior week. The database processes sales from POS and the pick instruction executes based on the sales from the host system to WMS to fulfil exactly what the stores need. If stock is not selling in certain, it is redirected via the Inter branch transfer (IBT) process is to move stock from one store to another to meet demand. In the case of the online store, the business only catalogues fast selling stock on the website. If stock is not selling, the stock is flushed out of On the Dot and removed from the catalogue as the apparel business is 70% fashion and needs to make sales within a specific window. Respondents were asked at what point in the distribution centre is the decoupling point since a forecast and demand driven strategy is being used.* The Apparel division has core, new fashion and replenishment fashion products which are cross docked or picked. The business forecast new fashion and core and replenishment fashion are fulfilled via cross dock or the picking process based on demand.

Respondents were asked to elaborate on how the bullwhip effect was managed at the beginning of each season when the anticipatory model was used. ***The anticipatory model inclines the business to manage inventory variances arising from long lead times between international suppliers and the DC, in effect increasing distribution costs to match supply to demand.*** Retailer X sources 55% of their stock internationally and the remaining 45% from local suppliers. The transit time via sea freight is 30 days on average. If there is a forecast inaccuracy, the allocation cannot be adjusted until the stock reaches the Durban Port and the order cannot be amended. If demand has suddenly decreased and there is excess stock, the stock has to be staged at a point in the supply chain. *The process for staging excess stock sourced internationally is to first stage it in the DC yard. If the yard is full, it is kept at for 21 free days with South African Container Depot (SACD). It is thereafter received into the DC as on hold stock. The pre-pack stock is also reclassified as on hold stock. Once the merchants are ready to release the stock, it is moved to the pick face. The additional touches presents a higher supply chain cost as all the stock has to be picked to stores due to the change in demand. The prepacks cost 30c a unit to be processed as cross dock but 90c extra a unit is paid due to the stock being processed to holds and then the pick face*. If demand suddenly increased, the supply chain would have to respond to demand faster through near sourcing or the use of air freight instead of sea freight. As a value retailer, the respondent commented that air freight is a very expensive option for Retailer X.

In the case of locally sourced stock, Merchants have visibility of stock on hand and inventory expected into the business. They have the visibility and flexibility to adjust orders placed prior to mass production as well as change delivery dates to the DC and allocations to stores. Once the stock is in the DC, the cross dock allocation can be redirected through the use of print and apply (PANDA). The merchants change the allocation 2 days before delivery. Once the stock is in the cross dock process, new labels are printed for fulfilment to a store that requires the stock. Alternatively, stock is posted to the post location, moved to on hold or picked. The business has a sophisticated pick system whereby algorithms are used to calculate demand. As soon as the system sees that a store is overstocked with a specific product, it holds back inventory based on stock on hand in-store. Therefore, the warehouse control system (WCS) will not over pick stock to stores that have stock but fulfil based on demand. Once the stock has been picked and cross-docked, the distribution department has to plan for deliveries to local, outlying and international stores. The distribution manager commented that near distribution replenishment reduces the bullwhip effect as lead time for the courier is shorter since stock is held near stores. Lead time is larger when stock is held further away from the store, hence, the transporter has to travel long distances to deliver stock. Due to longer lead time for outlying and international deliveries, forecast planning is needed which also faces the implications of the bullwhip effect.

The business strategically compares stores with long lead time to similar stores situated closer to the DC based on demand and the customer profile. The business forecasts by store profile to apply a customized distribution strategy. One of the challenges with exportation is the fluctuation in the currency and the hedging of the currencies which are affected by the dollar. The business chooses to reprice stock destined for international stores to in the DC rather than the point of origin to cater for fluctuations in the currency. If there is excess stock in the network, it will be marked down in-stores or redirect to another store depending on the cost of moving stock between stores.

5.2.3.2 Initiatives taken by the operation to reduce cycle time and lead time

Respondents were asked how their department was contributing to reducing cycle time and lead time in the supply chain. ***Every department in the DC and transport operation is responsible for optimizing the throughput rate to minimise cycle time and lead time.*** Stock sourced from local suppliers are finalized 48 hours before delivery to the DC. If there are any changes the merchant has the flexibility to change the packing instructions and finalize the order. Stock sourced internationally is delivered to the DC in the Open to buy (OTB week). In some instances, the merchant may request a specific container based on demand. The DC has the ability to prioritise the container based on the requirements of the merchants.

The distance between departments, particularly receiving and put away staging, is strategically set up to enhance the flow of products. In the fulfilment operation, stock is put-away, pulled and picked by department. However, the strategy is to have put-away, pulling and picking by wave category to ensure cartons are store ready. The average stock turnaround in the reserve locations is 3-4 weeks and department grouping by velocity. Fast moving products are situated at the front of the rack to reduce the lead time by pulling from the first isle rather than the last isle. The DC has classified the pick face into three tiers, one of which is a golden zone which is the centre of the pick face. Stores with high demand are situated in the golden zone. Boxes closed faster and dispatched quicker to ensure shorter lead time to the online and fulfilment store as well as stores with the highest demand. The online and fulfilment stores are given preference on the pick face over other stores to ensure stock is picked and moved off the pick face in the quickest possible time.

5.2.3.3 The last mile

The level of visibility of inventory and orders and the service level agreement between the retailer and 3PL has an implication on the last mile for store replenishment and order fulfilment. The website and mobile application catalogues items which are held at the online store. The allocation to the online store and fulfilment store is based on demand and the cost of transportation. This strategy was adopted to reduce courier cost and lead days of delivery from store through close-to-source deliveries. Currently, the online store supplements the fulfilment store in the event the fulfilment store is out of stock for a particular SKU. If the picker cannot locate the item, the order is picked failed and is redirected to the online store. According to some of the respondents, this process facilitates more control of inventory through the use of the online store whilst achieving reduced cost, effective use of stock, reduced distribution cost to customer and enhanced speed to market through the use of fulfilment stores. The online and fulfilment store have customized operational processes. The process is system based on route optimization.
Couriers will only pick up at specific time and send the stock to the hub based on the planned sorting time and plan loads and vehicle types based on expected volume.

The online facility expects a delivery between 8-10 in the morning to manage inbound and outbound. They have integrated systems with the company in the case to see what stock is expected for delivery through the advanced shipping notice. The information is received by the facility 2 days in advance which also aids with labour planning. The layout, height and categories of the product within the facility are grouped as the layout influences the pick rate. The online store previously used multi-item locations which required the picker to search for the items in the location as the location held more than one item. The process was time consuming. Now the online store has smaller single item locations. The boxes are open and are easily accessible in contrast to being stacked. By having the stock well laid out, less time is spent looking for the item, which speeds up the pick. *The online store has adapted their system for business to consumer fulfilment which requires fine picking in comparison to full case picking. Labour brokers are used to achieve flexibility in the operation. On the last mile, the in house logistics management system (LMS) is integrate with many preselected couriers based on courier cost optimization using a predefined algorithm to select the cheapest courier that can deliver the order the fastest*.

The fulfilment store has a dedicated person to pick the stock from the shop floor, as a result, the associate needs to know the departments well. Door to door orders are prioritize first, followed by store economy and store express. The associate reviews if the SKUs are available on the system. *If the SKU is not found on the floor or in the stock room, the order is pick failed and redirected to the online store.*

Door to door orders are collected from the fulfilment store at 12pm and store economy and store express orders are collected at 4pm. If the courier misses the time to pick up. It is picked up the next day in the morning and delivered to the designated collection store. There are designated click and collect express queues for the customer to collect their order in-store. The online store picks and packs within 24hrs and can achieve same day delivery for areas with close proximity to the facility. The fulfilment store plays a similar role to the online store but is able to provide same day-next day delivery in the region the store is situated.

Different organisations have different key drivers for click and collect. In some organisations high availability is a key driver whilst in other organisations higher service level is a driver. Changing the availability of the courier company has an implication on cost and quality. There is a trade-off between low volume and high variety processes versus high volume and low variety processes. From a routing perspective couriers provide additional services to identify the cartons so that it gets some form of priority using track and trace. The form of prioritisation used is dependent on the cost to service.
Overnight deliveries maybe nominated compared to a delivery with a 3 day lead time. The option with the 3 day lead time may utilize the existing network whilst the overnight delivery may require a specialised delivery vehicle which is out of the usual distribution network. The overnight delivery can be done at a higher price point compared to the 3 day delivery. In the current model for store economy, the courier is meeting a price point. If delivery is made to a specific store and the delivery is rolled over to another day, the customer's order will not be delivered. The customer's order is not treated as separate store stock since it is part of the load for the destined route. Cartons loaded at the courier loading store economy orders follows FIFO. The cartons are not being sorted for normal store cartons vs customers order cartons. Deliveries via post office are cost effective with longer lead times as deliveries via economy.

In the case of deliveries via door to door and store express, the online store has a system that optimizes door to door and door to store deliveries using predefined algorithms in the logistics manage system . The system selects the most cost effect courier. However, the rate is still at premium compared to store economy deliveries. For international deliveries, if the customer is not available to receive the order after an agreed date and place of delivery was established, the courier charges the customer for holding the order. *The 3PL developed a track and trace software like the Uber model whereby there is visibility of the parcel and delivery vehicle. Other couriers contracted with them also use similar applications to gain visibility and achieve route optimisation.* The e-commerce manager described store fulfilment as being pivotal in achieving on time delivery and concluded that the objective of omni-channel is to exceed the customer's expectations.

5.2.3.4 Fill rate and order condition

Respondents were asked to comment on initiatives in place to improve order accuracy and fill rate. ***Omni-channel retailing exposes stock accuracy as online orders need to be fulfilled at SKU level. Stock inaccuracies are detected at stores during scheduled stock takes whilst fulfilment stores reconcile inventory on a daily basis. Garments are packed in polybags, otherwise there aren't many precautions to maintain the condition since the items are not fragile in nature.*** The implementation of stock on hand tolerance levels, audits processes and cycle counts manages stock accuracy and fill rate. The e-commerce system has a tolerance level set whereby if there are 3 units remaining in the fulfilment store, e-commerce sees it as zero. The online and fulfilment store is set to 100% audit in the DC contrast to blind receiving for traditional brick and mortar to ensure the stock visibility is 100% accurate. Cycle counts are performed regularly to identify damages, write offs and incorrect item attributes in advance as opposed to the inaccuracies being recorded in the stock ledger. All e-commerce stock is therefore presumed to be saleable. The system at the fulfilment store lets the user view the code and the picture of the stock and rejects incorrect items that were scanned. However, in some instances, size issues are identified. The online store performs a pre-scan, followed by a detailed scan whereby every item received is scanned and the stock on hand is verified every day. All defective or excess stock is sent to the returns DC to be flushed out to the Clearout store. If orders cannot be fulfilled by the fulfilment store, the orders are redirected to the online store. If by some chance the online store and fulfilment store cannot fulfil the order, the process is for customer service to contact the customer to fulfil the order without the item. Most inaccuracies occur due to the eft process in comparison to payment via credit card as a result of the delay in using eft. The respondent added that more integration is needed for EFT as every step in the process needs to be integrated for successful omni-channel execution.

5.2.4 The contribution of integrated information systems towards information sharing and visibility within the virtual omni-distribution network

The supply chain uses a single system comprising multiple sub-systems which are linked from the point of PO creation until stock is delivered to the store however, the subsystems are not integrated in real time, nor is there visibility of the last mile. An integrated system such as a Distribution Order Management system (DOM) such as the Manhattan programme provides real time updates with a view of global stock on hand. DOM also backward integrates demand and allocates the best place that demand should be fulfilled from based on location to customer proximity which is channelled through the system Fibre is currently being used in the online store and fulfilment stores however, the fibre roll out in SA is slow and outlying stores will not get fibre. This problem does not exist overseas in developed countries.

The ecommerce system which is also linked to the host system receives historic information concerning each touch point in the order process however, the data is not in real time. The e-commerce team uses a web order dashboard which provides visibility of the courier, tracking number, payment method. However, there is no visibility of the last mile, between the order being shipped and delivered and as a result there is no end to end visibility of every touch point. The transport service provider recommended a single customer management process as the retailer and logistics provider are both running a call centres to assist with customer queries. Currently, orders cannot be split for fulfilment to occur from different sources. The business still needs to develop the omni-distribution model.

5.3 Conclusion

The findings from the survey reflect that a multitude of fulfilment centre and fulfilment channels are being used to fulfil orders in the Retailer X omni-distribution model. Store manager's rate the current orders fulfilment process as being effective on the basis of the fill rate, lead time and order condition of orders delivered via store economy and store express. However, the survey did not include the door to door shipping method and delivery via the postal service for local orders as stores are not exposed to these shipping methods, as a result, it was necessary to establish the extent that orders were being fulfilled via door to door and post relative to delivery via store express and store economy in South Africa as well as the services offered internationally. The data analysis examined the fill rate and lead time for orders delivered in South Africa and internationally in 2014 and 2015 in respect of the service level agreement which guided the interview questions. The discussion chapter amalgamates the findings to elucidate how the distribution system has been adapted to fulfil demand whilst remaining competitive.

CHAPTER SIX

DISCUSSION OF RESULTS

6.1 Introduction

Omni-channel retailing offers customers a seamless and customised shopping experience. The study aims to establish how retail companies are managing their distribution network due to the change in shopping channels offered, to fulfil demand on a global scale. Using Retailer X as a case study, surveys and interviews were conducted to establish how distribution systems have been adapted to manage lead time, cycle time and fill rate and to establish the current service level of online orders in respect of the distribution system and information systems used.

6.2 Objective one: To determine the effects of omni-channel retail adoption by retail apparel companies in managing the transformation of the supply chain retail distribution systems.

6.2.1 The effect of having adopted multiple purchase channels on sales

In a bid to remain globally competitive, South African retailers such as Retailer X extended to the online platform to offer customers additional purchase channels. Deloitte Touche (2014:19) reports that the European fashion industry experienced an increase in sales having extended to online channels and adopting omni-channel retailing. Top Shop, High Street retailer, sells to 112 countries through its omni channel strategy. Its profits have increased by 26% which is supported by 33% increase in international sales (Deloitte Touche, 2014:1). American based company, Macys, had achieved a 51.7% growth from 2011 to 2012 having adopted an Omni-channel approach (Tetteh & Xu, 2014:1). Analysis using frequency distribution and Chi square established that there is an association between adoption of multiple purchase channels and sales. The findings of the survey establish that 60.1% ($p<0.025$) of the respondents are of the view that the extension to online buying increases sales. The rate of growth across various channels has increased sales but not to the same extent as international retailers. The omni-channel approach is new to the South African market and retailers are adapting to it differently. There is a conversion by existing shoppers, of convenience and pricing of buying online instead of via store, as opposed to a significant increase in market share across the omni channel.

The findings from the case study disclose that the number of orders delivered in 2015 compared to 2014 increased by 14% (Retailers X, 2016). The division reported 18.9% retail sales growth and 203.5% e-commerce sales growth in 2014 and 18.0% retail sales growth and 51.0% e-commerce sales growth in 2015 in the annual financial statements (Retailer X, 2014:36) and (Retailer X, 2015:35). Based on the empirical findings and supported by the literature, the increase in online sales and sales across the brick and mortar and, the adoption of multiple purchase channel has steadily increased sales in the business. Kearney (2014:1) is of the view that the brick and mortar is a necessary component of the omni-channel as 66% of customers visit the brick and mortar before or after purchasing online. In addition, respondents are of the view that whilst e-commerce (e-com) is achieving sales, it is also increasing store sales as customers collect online orders in store and purchases more items whilst in store. Click and collect utilises the brick and mortar for in store collection, however, it also generates additional in-store sales. The growth of omni-channel retail sales is supported by the holistic customer journey and service offering.

6.2.2 The impact of having adopted multiple retail channels on the assortment of fulfilment channels

The demand for a more seamless and flexible shopping experience has resulted in retailers having to realign operations within their supply chains to become more digitised and integrated (Ervasti *et al.,* 2014:2, Fortna, 2015:2). The emergence of omni-channel retailing requires retailers to have visibility of the supply chain with cross channel capabilities which can fulfil from anywhere via the omni-distribution system. International retailers, John Lewis and House of Frasier, had shown a growth of 100% in online sales from 2006 to 2007 (Turner, 2014). They have integrated brick and click methods of buying to facilitate the delivery of online purchases to stores via door to store deliveries (Turner, 2014). The growth in the usage of multiple fulfilment channels is supported by the use of brick and mortar especially with the advancement of geo-location capabilities (Oracle, 2014:3).

By analysing the frequency distribution and binomial tests, it was established that the adoption of many retail channels influences the supply chain retail distribution system (60.2% ($p<0.025$)). The average number of channels fulfilled by stores is significantly larger for those stores that identified that Retailer X offers multiple purchase channels (3.29) than those that identified that Retailer X adopts single purchase channels (1.51), $t(71.269) = -6.546$, $p<0.025$). The adoption of multiple purchase channels therefore increases the assortment of channels fulfilled by stores. However, whilst the brick and mortar fulfils orders from other channels, its functions remains predominantly within the brick and mortar operation. Store respondents (79%) identified that majority of the cross channel buying is from online purchase and in-store pick up.

This result is supported by the case study as store economy orders grew by 46.8% from 2014 to 2015 as depicted in table 2.5. Although door to door deliveries comprised the most commonly used delivery methods, the findings indicates that delivery of online orders to store had a higher growth percentage than the delivery of online orders to the post office.

6.2.3 The impact of having adopted multiple retail channels on the assortment of fulfilment centres

Retailers using an omni-channel approach can physically fulfil orders from four types of facilities: combined distribution centre, separate store fulfilment for online and in-store orders, combined store fulfilment and hybrid fulfilment (McCrea, 2014:57). The type of facility indicates how the distribution system has had to adapt for omni-channel retailing. Majority of the respondents agreed that the distribution network is currently centralized. A combined distribution centre which services all channels achieves economies of scale since the fixed cost per unit is reduced as more units are distributed out of the single facility. However, the use of a combined distribution centre may be limited by long lead times since there is a greater distance between a central distribution centre and the destination in comparison to the distance between multiple decentralised distribution centres and the destination (McCrea, 2014:57). The assortment of fulfilment centres is significantly larger for those stores that fulfil multiple channels (2.14) than those that fulfil a single channel (1.22), $t(75.869) = -7.290$, $p<0.025$. In addition, whilst the distribution centre remains a primary fulfilment centre (92% ($p<0.025$)), depot and store fulfilment remain as secondary fulfilment centres. Respondents agreed that the adoption of many retail channels influences the supply chain retail distribution system (60.2% ($p<0.025$)) and in the case of Retailer X, it has adapted its distribution network for cross channel buying to fulfil the needs of customers (77.4% ($p<0.025$)).

The results from the survey indicate that an increase in the number of purchase channels has proliferated the number of fulfilment channels and fulfilment centres. The assortment of purchase channels necessitates the use of door to door delivery and store delivery of online orders in addition to traditional store delivery from DC. The additional channels compels the need for additional processing by the DC, transporter and stores as well as more stringent stock management across the supply chain. Near source fulfilment is an enhancement on the traditional model whereby store fulfilment expands the local network. However, DC and stores are tasked with fine picking, packing and dispatch function for online orders from the omni-channel and there is an associated courier service cost in delivering the order to the customer and store in a shorter time. It may be argued that a hybrid distribution strategy has been adopted since store fulfilment functions on the principles of a decentralized network and the Retailer X model is achieving the benefits of centralized and decentralized strategy due transhipment being made between facilities.

However, within a hybrid network delivery, flow can follow a many to many relationship from suppliers to facilities as well as a many to one relationship but the Retailer X model only permits delivery by suppliers to the centralized distribution facility and the model necessitates the use of transhipment between stores based on demand. Globally, countries with a store presence will also be leveraged as Retailer X is attempting to do with the expansion to Australia. As an alternative Agatz *et al.,* (2008:348) suggest that e-fulfilment and store fulfilment be made through the same distribution centre as opposed to the use of an online store and fulfilment stores. The realized benefit is the close proximity of stock from the central DC, however, the transport implication of long in-transit times can potentially inhibit service delivery.

6.2.4 The impact of fast fashion retailing on omni-distribution

Fast fashion retailing is demand driven and requires agility and flexibility as key differentiators in the supply chain (Raisanen, 2013). Respondents agree that the fast fashion retailing channels require agile supply chains with quick response strategy and shorter cycle times (78.1% ($p<0.025$)). Near to source distribution works in favour of fast fashion retailing since replenishment is faster and turnaround times are shorter. Whilst omni-distribution is defined as the capability to fulfil orders from and accept returns to distribution centres, stores and vendors whilst having complete visibility and flexibility to manage inventory across all channels (Fortna, 2015:2), it is implemented with the purpose of satisfying demand at a price that is acceptable to the customer and profitable by the retailer (Mcbeath, 2014:2). Barry Blake, vice president of research at SCM World, is of the view that the success of omni-distribution is dependent on the extent to which the logistics partners enhance flexibility and speed and reduce cost in the system (McCrea, 2015: 54). Omni-distribution therefore supports agility and flexibility required in fast fashion retailing. The adoption of omni-channels, even in the case of fast fashion retailing, has resulted in the proliferation of fulfilment centres and fulfilment channels used in the distribution network to enhance speed and agility for the same day and next day deliveries.

The distribution system has had to adapt for the omni-channel evolution. Foschini has two central fulfilment locations in Johannesburg and Cape Town in comparison to Retailer X which has a central online channel in Johannesburg and regional store fulfilment in Cape Town and Durban which the business is trying to grow across the country. To maintain a fast responsive model, the business has opted for this approach to manage stock more tightly and to reduce cost through cheaper fulfilment and transportation of stock to stores. Although international retailers commonly utilizes home deliveries, the South African landscape is more dispersed and the cost of distribution of orders to outlying areas prohibits delivery. However, as per practises in the UK, collection points for online orders is an emerging trend in South Africa.

In the case of international orders, countries that Retailer X has a store presence in, will be leveraged, alternatively expedited mail system (EMS) and courier is used for door to door deliveries.

6.3 Objective two: To examine the extent of relative change in demand to which the distribution systems enhance frequencies of order fulfilment to shorten lead time and cycle time

Order cycle time constitutes the variance between the customer order date and the date the order was shipped from the warehouse and distribution centre (Arnold and Reese, 2015:2), whilst lead time is inclusive of in-transit time as it is measured up to the point that the order reaches the customer. The supply chain of Retailer X is built on long lead times since majority of the stock is sourced internationally. Owing to long lead times and unpredictable demand, the supply chain has to become decoupled to implement the 'leagility' strategy whereby the supply chain moves from a lean strategy to a an agile strategy at the customer order decoupling point (CODP) (Olhager, 2012:40). The DC plays a pivotal role in processing inventory for dispatch to the brick and mortar, online and fulfilment stores. There are multiple operational activities conducted that influence lead time and cycle time.

6.3.1 The influence of operational activities in the distribution network on lead time and cycle time

Agile supply chains require quick response strategy with shorter cycle times by reducing the length of the pipeline or speeding up the flow through the pipeline by removing bottlenecks, excessive inventory, utilizing sequential processing and maintaining visibility (Christopher, 2005:133). In a facility that serves as a cross dock and warehouse, the cross dock process enables JIT distribution scheduling to reduce inventory cost, inventory levels and lead time (Alvarez-Perez *et al.,* 2009:554). In a facility that conducts item picking, item put away, necessitates designated location of SKUs as an imperative to the cycle time as efficient pulling facilitates faster throughput of stock, as in the case of grouping (Lahmar, 2008:24). Respondents underpinned customer demand as having an influence on 'in full' and 'on time' order fulfilment in the overall distribution system (75.7%, $p<0.025$). This is attributable to the change in demand influencing fulfilment lead time and cycle time in the distribution network (65.1%, $p<0.025$) which has resulted in the omni-distribution system of Retailer X pulling supply chain activities from demand driven orders to reduce system inventory (67.2%, $p<0.025$). The distribution system has to adapt operations to fulfil demand.

The business built in flexibility upstream in the supply chain to allow for a change in the packing instructions prior to finalization of the orders with local suppliers 48 hours before the order is delivered to the DC. However, international sourcing poses a challenge since the order cannot be amended months before delivery due to long in transit times. The decoupling point therefore becomes imperative for mass customization upstream and postponement downstream to match supply to demand. The DC has built in flexibility to prioritize containers at the receiving department based on demand. The use of cross dock and flowthrough processes, facilitates faster throughput of stock to the courier and the pick face respectively and the print and apply (PANDA) machine allows the business flexibility to change the allocation of a cross dock box based on demand.

Inventory can be classified by static and dynamic pick locations based on SKU movement. The rate of location usage is a key contributor to cycle time as the workflow of activities and the layout influence efficiency of stock movement. Grouping and fixed location allocation are presumably more organised and facilitates more efficient pulling from the location in comparison to arbitrary allocation (Lahmar, 2008:24). The average stock turnaround in the reserve locations of Retailer X is 3-4 weeks and departments are grouped by product velocity. Fast moving products are situated at the front of the rack to reduce the lead time by pulling from the first isle rather than the last isle. Fortna (2015:5) suggests that retail replenishment profiles be established and compared across channels to determine if there is similarity between profiles so that pick modules can be shared to reducing excess stock and enhancing picking efficiencies. Discrete order picking, zone picking, batch picking, wave picking and a combination of each, namely; Zone-Batch Picking, Zone-Wave Picking and Zone-Batch-Wave Picking, are amongst the common order picking methods (Trifactor, 2008). The alternatives present trade-offs between accuracy, time and cost.

Stock is put-away, pulled and picked by department which maybe time efficient in comparison to wave picking but results in inaccuracies which has an implication on store fulfilment. In contrast, discrete order picking achieves a high fill rate but a significant amount of travel time is used. The strategy of Retailer X is to have put-away, pulling and picking by wave category to ensure cartons are store ready to achieve shorter cycle time and higher fill rate. In addition, the online and fulfilment stores are given preference on the pick face over other stores to ensure stock is picked and moved off the pick face in the quickest possible time. Nopolitino (2013:53) suggests the use of zone-batch picking for enhanced productivity whereby SKUs are picked into multiple orders but the pick face is limited by the quantity of pick profiles and SKUs. Retailer X's online store used to hold multiple SKUs in a single location which wasted time as staff had to search for the SKU.

The location classification has been changed to multi-location facility to control SKU movement, enhance pick rates and the fill rate. Store picking has also presented an opportunity for retailers to reduce transport cost via the semi-extended order fulfilment strategy. The survey result presented that 66.9% ($p<0.025$) of the respondents felt that their branch could perform additional picking function whilst 26.4% felt that they could not. In addition, 79.1%($p<0.025$) identified that their store is able to process the order in time for pick up by the customer whilst 14.9% identified that it is not possible to process the order in time for pick up. Store fulfilment utilizes discrete order picking. Whilst it achieves a high fill rate, a significant amount of travel time is used. As a result, a dedicated fulfilment team is used to pick, pack and despatch orders from the fulfilment store. The outbound operation works closely with the 3PL due to the 3PL being situated in the same building. Cross docked boxes are received by the 3PL within a few hours with pick cartons and loaded by region. The close interaction with the 3PL facilitates faster throughput from the DC to courier to ensure shorter turnaround times.

6.3.2 The decoupled supply chain

In response to the volatile retail environment, decoupled supply chains accommodate long lead times and volatile demand. Using the push-pull theory, long lead times are accommodated using the anticipatory model which maximises efficiencies through mass production. At the customer order decoupling point (CODP), demand is known and is fulfilled based on a responsive model (Christopher, 2005:120) and (Olhager, 2012:37). Using a JIT scheduling process and a make to order environment, the pull theory aligns inventory supplied to inventory demanded to facilitate high fill rates and elevated customer service levels through rapid fulfilment of demand using the quick response strategy (Zylstra, 2006:185) and (Rossin, 2012:8).

When demand is unknown, the supply chain can be decoupled to respond to demand in full by forecasting orders until stock reaches distribution and then distributing stock based on known demand (56.1%, $p<0.025$) by pulling supply chain activities in the omni-distribution system (67.2%, $p<0.025$). The use of a main distribution center and multiple smaller distribution facilities benefits mass distribution (68.8%, $p<0.025$). Consolidation and delayed differentiation strategies are used in a distribution environment to synchronize supply to demand through inventory pooling and delaying distribution until demand is known (Cachon and Terwiesch, 2009:340). Bowersox *et al.*, (2010:247) support this view and add that this type of strategy is in line with the JIT distribution concept of distributing stock when needed due to an increase in the frequency of trips to stores. The decoupling point in the businesses supply chain is the fulfilment centre due to the picking operation and the use of the PANDA technology which facilitates a change in allocation of the cross dock carton.

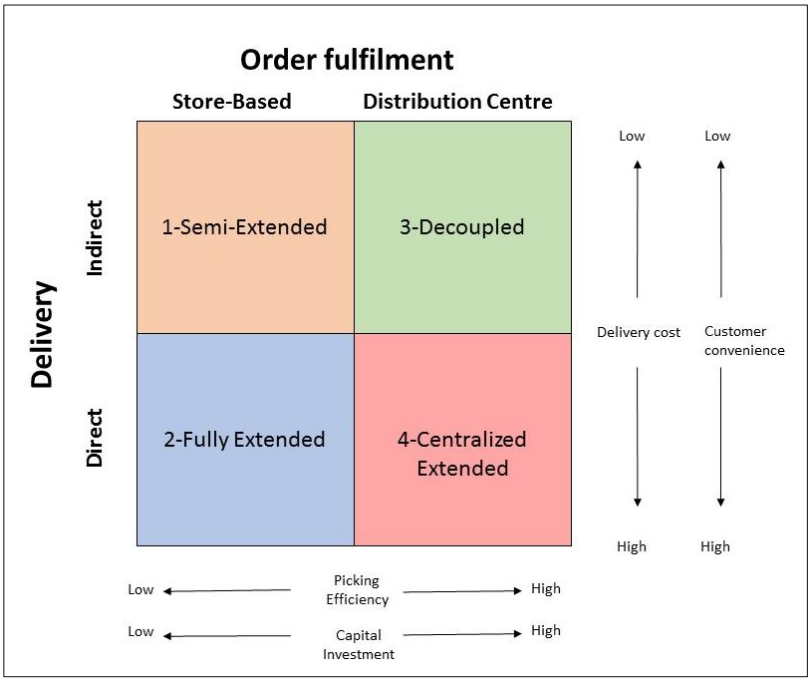
The lean strategy is adopted upstream in the supply chain whereby orders are pre-packed by suppliers. However, the agile strategy is implemented in the DC due to the use of PANDA technology on the cross dock cartons and the picking process which always pick based on demand. Under the push theory, inventory is produced under a make to stock environment to achieve economies of scale and to cope with long lead times until inventory reaches the customer order decoupling point (CODP). At the CODP true demand is known and JIT distribution is used to fulfil orders pulled by customers in full and on time (Christoper (2005), Cachon and Terwiesch (2009), Rossin (2012) and Olhager (2012). The use of the push-pull theory underpins JIT levelled distribution as the initiatives and operational processes in the DC appear to be aligned with supplying stock when demand is known to create efficiencies and minimize waste. The push component of the push-pull theory is susceptible to inventory variances until true demand is known. The supply chain is inclined to the bullwhip effect when the anticipatory model is being used (Simchi-Levi *et al.*, (2008:189). The business compares stores with long lead time to similar stores situated closer to the DC based on demand and the customer profile. The business forecasts by store profile to apply a customized distribution strategy. Retailer X is therefore exposed to the bullwhip effect due to the long lead times for delivery from the port of origin to South Africa for international freight. The implication of forecast inaccuracies is that the DC has to stage the stock and pick SKUs that would have been cross docked. As result, the cost per unit is .60c more. In addition, the matching of international freight received to demand exposes the business to higher inventory holding cost, the SKU becoming obsolete and lost sales in the event the product is suddenly not selling well due to change in demand over time.

A centralized strategy achieves global optimization which is concerned with a system wide strategy being utilized across facilities and processes to achieve an outcome that is optimal for the supply chain. In addition, risk pooling is possible through the aggregation of demand from multiple regions thereby reduces demand variability and the likelihood of the bullwhip effect (Radovanovic and Zivotic (2013:279). The benefit of risk pooling in a centralized facility, followed by delayed distribution counteracts potentially lost sales through aggregated demand in the country. As a result, it facilitates supply and demand matching across purchase channels in contrast to separate fulfilment centres being used for each purchase channel, as in the case of a multichannel approach. Furthermore, the use of the omni-channel exposes the customer to products through various channels rather than solely the brick and mortar. Through a broader product assortment offered via online channels demand is aggregated by risk pooling (72.6%, $p<0.025$). The use of a push-pull strategy appears to minimize the occurrence of the bullwhip effect as a result of the customer order decoupling point existing in the supply chain.

6.3.3 Last mile of the supply chain

The myriad of fulfilment channels, associated shipping methods and lead time in an omni-distribution network necessitates the use of the last mile in the supply chain. According to Lau (2012:648), a one size fits all supply chain solution cannot be utilized in a demand driven retail environment that is striving to achieve quick response and efficiency. The author adds that the order size and value relative to lead time challenges distribution to aggregate and consolidate orders. A customized solution of matching demand with supply chain distribution is necessary to enhance distribution efficiencies. The adoption of omni-channel retailing requires the adaption of the distribution network to accommodate for cross channel buying to fulfil the needs of customers in full and on time as online orders require customised shipping methods. The order fulfilment matrix by Boyer, Frolich and Hult (2005:19) illustrates that the decision to extend the supply chain is based on the location of order fulfilment and method of delivery. The semi-extended, fully extended, decoupled or centrally extended strategy of the order fulfilment matrix, directs that order fulfilment can occur either from a store or distribution centre and delivery of the online order can be made directly to the customer's home or picked up from the store or distribution centre.

Figure 6.1: Order Fulfilment/ Delivery Matrix



Source: Boyer, K.K, Frolich, M.T and Hult, G.T.M. (2005) Extending the supply chain. 1st edition. New York: Amcom Books

The semi-extended strategy refers to orders that are fulfilled from the store and picked up at the store by the customer. This strategy offers customers low delivery cost. Boyer *et al.*, (2005:19) describes this strategy as being less convenient for the customer, more inefficient and challenging with regards to inventory tracking in-store compared to the distribution centre depending on the inventory system being used. Retailer X adopts this strategy through store economy and store deliveries using store fulfilment. Although this shipping method comprised 27.2% of orders shipped via door to door as depicted in table 3.4, it grew by 46.8% year on year in comparison to door to door which grew by 27%. However, the use of store express declined by 38.3%. The fully extended strategy makes reference to order fulfilment that occurs from the store and delivery is made directly to the customer. Picking efficiency and capital investment maybe low since fulfilment is from store however, delivery cost and customer convenience will be high (Boyer *et al.,* 2005:19). Retailer X offers customers door to door delivery through order picking from the fulfilment store.

The decoupled strategy refers to order fulfilment which occurs at the distribution centre and is picked up from the distribution centre by the customer. This strategy is used by companies that want to achieve low delivery cost and high picking efficiency, however, it also incurs low customer convenience and high capital investment (Boyer *et al.,* 2005:20). Centralized Extended strategy refers to order fulfilment from the distribution centre and deliveries directly to the customer. Companies using this strategy are likely to achieve high delivery cost whilst providing high level of customer convenience as well as high picking efficiency and high capital investment (Boyer *et al.,* 2005:20). Retailer X does not use the decoupled strategy for deliveries as the stores and courier only interact with the customers. The online store serves as central hub for orders as it catalogues SKUs based on orders received into the facility. The centralized extended strategy is adopted through door to door deliveries whereby orders are delivered from the online store to customer designated place of delivery if there is no regional store or if the regional store cannot fulfil the order.

According to Simon (2014), a considerable portion of South African customers have difficulty with the conveyance of products as it is time consuming and expensive. The author further states that omni-channel retailing must facilitate convenient shopping using integrated cross channel order fulfilment. Urban Studies (2014) revealed 79% of South African shoppers surveyed, preferred door to door delivery by courier rather than registered post as the deteriorating postal service has struggled to absorb the workload in South Africa (Prinsloo, 2015:8) and were reported to have high theft levels (PWC, 2012:21). Postal service appears to be less used as the data analysis from the case study reflects a 92.4% decreased year on year in the use of postal delivery. Whilst door to door is predominantly used, it is also the most expensive shipping methods.

The business therefore elects to utilize the current distribution network to facilitate in store collection for the cost conscious customers that want the convenience of shopping online. This semi-extended strategy is beneficial as it reduces courier cost and lead days of delivery from store through close-to-source deliveries. Although deliveries via store express declined by 38.3%, the data analysis revealed that customers paid a premium rate for express delivery yet only 66.3% of orders were on time compared to door to door deliveries where 75.7% of orders were on time. Furthermore, door to door delivery offers more convenience than store express deliveries.. However, there are set up and maintenance costs of running store fulfilment. The e-commerce manager advised that the approximate start-up cost is R152 563.36 and the average monthly cost to maintain the fulfilment store is R22 000. Furthermore, to ensure the success of the semi-extended strategy, the training of stores associate, advance visibility of the order, reliable courier company and the courier collection time is critical in delivering the order in full and on time. The utilisation of a fulfilment store is warranted by the demand for online orders. Door to door orders fulfilled from stores, are collected at 12pm whilst store economy orders are collected at 4pm. According to the 3PL, changing the availability of the courier company also has an implication on cost and quality. There is a trade-off between low volume and high variety processes versus high volume and low variety processes.

6.4 Objective three: To ascertain how the demand-driven omni-distribution systems influence the order fulfilment frequencies in a designated supply chain network

Perfect order fulfilment encompasses the delivery of the correct and complete order in immaculate condition to the customer on time with the correct documentation (Dwyer, 2015:1). The top five value services identified by (Kilcourse and Rowen, 2014) were same day shipment, followed by drop shipment from vendor direct to customer, drop shipment from vendor direct to store, online visibility into in store inventory and in store inventory pick up. Forresters (2014:5) findings correlate with the findings of Kilcourse and Rowen with the exception that that customers also expected a clear indication of when their order will arrive. Retailer X does not use drop shipment by vendor as ecommerce is still in its infancy and drop shipment requires a scalable operation. 55% of stock is sourced internationally and 80% of the online business comprises fashion products, as a result drop shipment of fashion items would be very erratic. Although the findings of the survey were that customers have SKU visibility online of stock in-store (75%, $p<0.025$), customers only have visibility of stock in the online store and fulfilment store since these stores carry the full catalogue. Brick and mortar stores are graded, as a result, the product range is limited to the size of the store and the store's customer profile.

6.4.1 Order fulfilment frequencies - South Africa

Order fulfilment frequencies are dependent on the shipping method used as the last mile influences the likelihood of order fulfilment. The survey results reflect that store managers are of the view that store economy (81%, $p<0.025$) and store express (71%, $p<0.025$) are frequently used shipping methods. However, only 64% ($p<0.025$) of responses rated that the online store as being effective to highly effective at fulfilling all online orders in full whilst 72% ($p<0.025$) of responses rated that the fulfilment store as being effective to highly effective at fulfilling all online orders in full. The results indicate that the fulfilment store is rated by a greater percentage of respondents as being effective to highly effective at fulfilling orders in full. Respondents (72%, $p<0.025$) rated the online store and fulfilment as being effective to extremely effective at fulfilling order on time and 76% ($p<0.025$)of the respondents selected that product condition is in good to extremely good condition.

The findings of the survey are indicative of the views of store managers concerning store deliveries but the fulfilment frequency for door to door deliveries and deliveries via post still remain an unknown. Furthermore, the fill rate and on time score for store deliveries necessitates further exploration via interviews and the case study to establish why orders do not achieve perfect order fulfilment. The data analysis from the case study reveals that orders delivered to South African customers achieved a 100% fill rates across all shipping methods in 2014 and 2015 whilst deliveries to international customer achieved 100% fill rate for deliveries via express whilst economy achieved a fill rate of 75.1%. The finding from the survey indicate that not all respondents are convinced that the online store and fulfilment store are fulfilling orders in full. Based on the feedback from the interviews, it is presumed that whilst there are measures in place to minimize stock inaccuracies in the online and fulfilment store, it is sometimes possible for the correct item to get picked yet the incorrect item to get packed or the same item but different size to get packed. The online store catalogues stock that has been received into the facility. The website and mobile application will only display items that the online store has available. However, if an item is out of stock, the item maybe removed from the order or the order maybe cancel which does not constitute a non-delivery. Orders not processed due to the item being out of stock, presents a lost sale. The omni-distribution systems appears to be achieving a 100% fill rate for all orders with the exception of economy for international orders which are shipped via the post office. High fill rates require high inventory levels yet supply chains are required to remain lean (Bowersox *et al.*, 2010:53). Although the fill rate is high, the supply chain still needs to keep cost and lead time lean.

The survey results for the order lead time in South Africa indicates that 72% ($p<0.025$) of respondents rate the online store and fulfilment as being effective to extremely effective at fulfilling order on time and the remaining respondents were neutral or rated the online store and fulfilment as being ineffective to extremely ineffective at fulfilling order on time for store economy and store express deliveries. The data analysis from the case study identifies that deliveries via store economy correlates to the responses by store managers as 88.1% orders delivered via store economy in 2015 were on time. However, only 52.7% of orders delivered via store express in 2015 were on time. The data analysis from the case study alludes that door to door and store express are struggling to deliver all orders on time despite the customer paying a premium rate for quicker delivery compared to store economy which has a longer lead time. Door to door deliveries comprises 54% of all orders in 2015 and represents 66.1% of total orders that were classified as late as illustrated in table 2.5. Store express reflects that 33.7% of orders were late, followed by store economy and post office which had 8.8% and 66.2% as depicted in figure 3.4.

Upon further analysing the order processing time and delivery time it was deduced that the order processing across all shipping methods is performed within 1 day and the result is mainly indicative of deliveries from the online store. It is presumed that couriers therefore have upto two days to deliver door to door and store express deliveries and there are upto six days for store economy and deliveries via post to be shipped. The delivery time was further analysed in respect of the region the parcel was delivered to. Figures 3.10-3.11 depict the dispersion of online orders via the door to door delivery method. The result implies that the distance between the online store and destination influence the lead time and that closer fulfilment stores could reduce the transit time for delivery in these regions. The regions that collected 70% - 80% of store economy orders in less than 7 day transit time appear to require an additional day for 95% of orders to be delivered on time as seen in figure 3.13. As a result of majority of fulfilment occurring from the online store, orders could have possibly been delivered later than expected. The results from figure 3.14 indicate that orders shipped across all regions, particularly Kwa-Zulu Natal and Limpopo province are well below the expected service level and is possibly why the percentage of orders shipped via post declined from 2 694 orders in 2014 to 205 orders in 2015.

The feedback from interviews revealed that store economy uses the same distribution network as the brick and mortar, as a result, 88.1% of the respondents are of the view that orders are being delivered on time. The data result confirms that the distance between the online and fulfilment store and customer affects the transit time and order fulfilment in terms of the SLA. In contrast, door to door and express deliveries have 3 days for orders to be processed and delivered from the online store and fulfilment stores.

If orders are delivered from the online store which is situated in Gauteng, the nominated courier has 2-3 days to collect and deliver the order within the country. The long transit time jeopardizes order fulfilment based on the SLA with the customer. Orders delivered via postal service worsened when comparing the percentage of orders delivered on time in 2014 and 2015. Delivery via post appears to not be in line with the 7 day SLA as majority of the orders took more than 7 days to be processed and delivered. It is presumed that some customers are opting for store economy deliveries as it is a cheaper shipping method whilst other customers are looking for convenience and reliability from door to door deliveries.

6.4.2 Order fulfilment frequencies - International

The lead time for international orders showed a year on year improvement of on time deliveries via economy (64.4%) compared to deliveries via express (11.2%) as illustrated in table 3.5. Although deliveries via economy showed an improved, it comprises the bigger percentage of total orders (92.7%), hence represents a shipping method with the highest % of orders that were not delivered on time (75.7%). Economy and express orders are fulfilled from the online store in Gauteng. Countries that comprise the biggest percentage of online orders delivered are seen in figures 3.14-3.15. United States, Australia, New Zealand and Zimbabwe were the top 4 countries identified. Although the quantity of international orders decreased from 2014 to 2015, the results still indicate that the lead time according to the service level agreement is not being satisfied for orders delivered to these countries. Economy orders delivered to Expedited Mail Service (EMS) has approximately 14 days in-transit time to satisfy the SLA. Zimbabwe scored the lowest percentage of orders there were in transit greater than 14 days as seen in figure 3.15. It is presumed that it is attributable to the orders being delivered within Africa in comparison to Australia, New Zealand and United States. Express orders delivered courier services has approximately 5 days in-transit time to satisfy the SLA. Australia, United States and Zimbabwe had more than 90% late. New Zealand has a slightly higher score of 18.8% as seen in figure 3.15 and 3.16. The result indicates that majority of the few orders being delivered via the express method abroad, is being delivered late.

The feedback from the interviews revealed that Zara's service model is built on faster fulfilment as the retailer is specific about what stock it wants to send to the specific store on a specific day. Their traditional business model is closely aligned with omni-channel high availability model as they strategize on 80% replenishment and 20% stock. Cotton on, H & M and Zara are using store fulfilment which are brick and mortar driven. Zara and H & M currently have 7 or 8 stores in the country. The long transit time between countries necessitates a brick and mortar presence. The feedback from the interviews revealed that Retailer X is still learning about global fulfilment as with the expansion to Australia.

They are still establishing their presence there and is in the process of building their brand. The company is not yet competing on the basis of stock availability due to the long lead time in the supply chain. According to Christopher (2005:65), perfect order fulfilment is calculated using the 'on-time, in-full and error free percentage. The error-free percentage relates to documentation, labelling and damage. Respondents surveyed were to rate the condition of the order when it is received into the branch using a 5 point comparative scale. 1 denoted extremely good condition and 5 denoted extremely bad condition. 76% of the respondents selected that product condition is in moderately good to extremely good condition. Order condition is not commonly measured compared to the fill rate and lead time, the data is not recorded. Furthermore, respondents confirmed that apparel items do not require special handling as in the case of fragile items. Using the responses from the survey, it is presumed that the store manager's experience of the condition of the order received in store can be applied to all e-commerce orders. Figure 6.2 quantifies the survey result using the comparative scale. The order condition is 83.6% based on the survey results.

Figure 6.2: Order condition- quantified survey result

Order condition	Survey %	Apportionment	Order condition
Extremely good	62%	100%	62.0%
Moderately good	14%	80%	11.2%
Fair	8%	60%	4.8%
Moderately bad	12%	40%	4.8%
Extremely bad	4%	20%	0.8%
			83.6%

Using the order fulfilment calculation in figure 2.1 and the calculated order condition in 6.2, the order fulfilment score in 2015 for South Africa and international amount to 59.1% and 40.1% respectively. If it is assumed that order condition is 100% based on the feedback from in the interviews, the order fulfilment percentage increases to 70.6% and 48% respectively. The poor lead time in the door to door and economy shipping methods diminishes the order fulfilment measurement even when order condition is assumed to be 100%.

Figure 6.3: Perfect order fulfilment 2015

Metric	South Africa	International
On-time delivery	**70.6%**	**54.4%**
Store Economy	88.1%	
Store Express	52.7%	
Door to Door	66.1%	
Post Office	26.9%	
Economy		64.6%
Express		9.4%
In-full order	**100.0%**	**88.2%**
Store Economy	100.0%	
Store Express	100.0%	
Door to Door	100.0%	
Post Office	100.0%	
Economy		75.1%
Express		100.0%
Order condition	**83.6%**	**83.6%**
Perfect order fulfilment total	59.1%	40.1%
Store Economy	73.6%	
Store Express	44.0%	
Door to Door	55.2%	
Post Office	22.5%	
Economy		40.6%
Express		7.9%
Perfect order fulfilment assuming order condition is 100%	70.6%	48.0%
Store Economy	88.1%	
Store Express	52.7%	
Door to Door	66.1%	
Post Office	26.9%	
Economy		48.6%
Express		9.4%

Source: (Retailer X, 2016. Data extract, Data report)

Customers' orders received in to stores from the online store and replenishment store were rated as being on time and in full without damage in less than 21 instances in the last six months by an average of 89% ($p<0.025$) of the respondents surveyed. The result correlates very closely to the store economy order fulfilment metric but store express achieves a lower result due to the high lead time.

Approximately 76% of the respondents underpinned customer demand as having an influence on 'in full' and 'on time' order fulfilment in the overall distribution system and 72.6% identified that the omni-channel distribution network supports order fulfilment through on time delivery and order fill rate. The result indicates that although delivery via store economy is highly effective, the lead time for store express, door to door and postal delivery is not optimal. Cape Town and Eastern Cape were described as being difficult regions to fulfil quickly from the online store since the transit time is 2 days from the online store which is situated in Gauteng. The last mile was described as being affected by numerous factors: incorrect postal codes which results in the order getting misrouted, the time the payment has been released for eft which causes a delay, there are split orders which need to be consolidated and customers are not being present at the nominated place of delivery. Visibility of information appears to be pivotal in establishing the cause of late deliveries in the last mile.

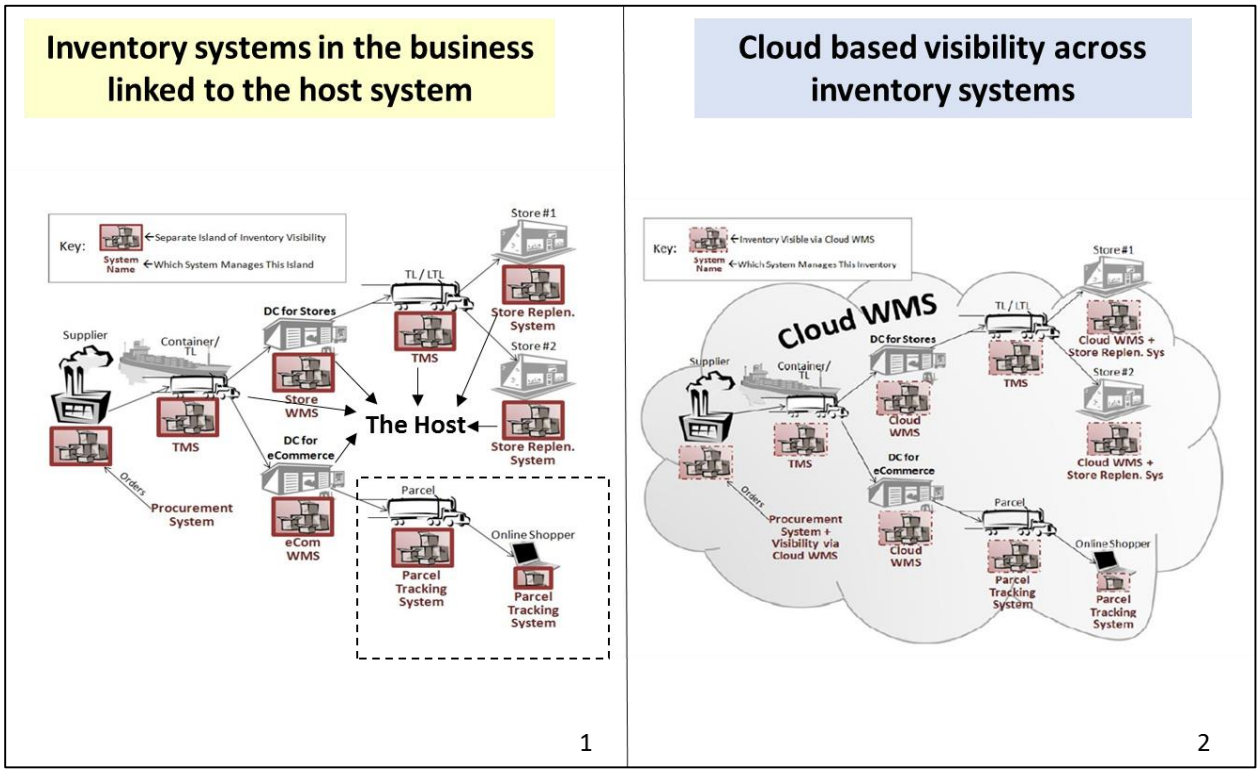
6.5 Objective four: To establish the perceived contribution of integrated information systems towards information sharing and visibility within the virtual omni-distribution network

A successful omni-channel supply chain is dependent on the information system and inventory management system's planning and executing capabilities as well as the extent of system visibility (Napolitano, 2013:49) through an integrated platform across business units which uses specialized system architecture and facilitate immediate communication throughout the business (Chain Storage, 2013). KWI, retailing service provider, advocates the use of cloud technology to attain data synchronization as seamless operations require instant access to data (Retail Information System News, 2015). The study found that the respondents were of the view that an integrated information systems improves in full and on time order fulfilment (73.6%, $p<0.025$) through enhanced information sharing and visibility within the virtual distribution network (67.7%, $p<0.025$). Integrated information systems supports better decision by encompassing visibility, traceability, accountability and profitability through cloud computing (Sparta System, 2016: 17). It assists with proactively identifying issues as well as investigating the root cause of problems to mitigate risks through data analytics. Ease of access to data is integral for quick decision making in fast paced supply chains as it assists businesses to cope with the volatile and rapidly changing retail chain.

Prinsloo (2015:6) reports that whilst the number of online users have increased due to the growth of m-commerce in South Africa, the electronic payment system via credit card remains a challenge. One of the e-com managers noted that inaccuracies also occur due to the eft process in comparison to payment via credit card as a result of the delay in using eft. The respondent added that more integration is needed for EFT as every step in the process needs to be integrated for successful omni-channel execution. Furthermore, the 3PL also noted that the retailer and logistics provider are both running call centres as the customer service department and 3PL attends to customers' queries. The lack of visibility in the last mile and poor transfer of information inhibits the order fulfilment process. Channels need to therefore become integrated to provide an excellent customer experience (87%, $p<0.025$). Approximately 71% of the respondents ($p<0.025$) agreed that cloud based technology provides visibility of detailed data in real-time, from various sources across the chain and enables businesses to respond faster to demand (81.1%, $p<0.025$). The adoption of cloud technology supports faster response to demand through information sharing. Although 79.1% of the respondents agreed that the Redworld POS system provides real time visibility of stock movement at SKU level, there was no clear indication of whether store operations had visibility of customer orders (47%, $p=.551$).

Figure 6.4 depicts a comparison of the Retailer X's host system and a cloud based system. The flow of data to the host system, illustrated in image 1 of figure 6.4, manages inventory movement from the point the purchase order is created until stock is delivered to the store. However, the warehouse management systems and 3PL systems such as Global Trade Solution (GTS), E-Tradex, the transport management system are not fully integrated with the host system in real time whilst the track and trace systems of each courier company is accessed separately to track orders as it is being delivered. The ecommerce system which is also linked to the host system receives historic information concerning each touch point of the order that was processed; however, the data is not in real time. The e-commerce team uses a web order dashboard which provides visibility of the courier, tracking number, payment method. Although the siloed systems relay information to the host system, the data flow is not live. In contrast, a cloud based system has seamless, real time visibility of data and offerings across all channels and provides businesses with the capability of responding to demand faster through information visibility and processing agility (RIS, 2015:3).

Figure 6.4: Comparison of Retailer X's system vs Cloud based system



Source: McBeathe, Omni Retailing Markets Association (IORMA). (2014) *Africa…In an Omni World*. [Online]. Available: http://www.iorma.com/reports/uk-retail-market-opportunity-report-may-2014 [1 May 2014], adapted by researcher

There is no visibility of the last mile in the business, between the order being shipped and delivered, and as a result there is no end to end visibility of every touch point. There is a transfer of information which needs to be addressed to ensure that there is visibility due to the integration. Order Management System unifies order processing across the retailer's distribution network of physical stores (70.2%, $p<0.025$). There was consensus amongst respondents that an integrated system is needed for better visibility and more informed decision making. Some respondents recommended the use of a Distribution Order Management system (DOM) such as the Manhattan programme as the business requires real time updates with a view of global stock on hand which it does not have at the moment. The DOM also backward integrates demand and allocates the best place that demand should be fulfilled from based on location to customer proximity which is channelled through the system.

Respondents confirm that integrated information systems improve the quality of service and customer satisfaction by reducing lead time and costs through information visibility and reduced administrative work. The automation of machinery and equipment such as conveyors, label printers, RF scanners and Volumiser and Cubiscan machines in the DC has promoted quicker fulfilment. However, the inventory system is not yet integrated across the business which distorts visibility and the management of inventory to impede order fulfilment.

6.6 Conclusion

The distribution system has adapted for omni-channel retailing through the proliferation of fulfilment channels and shipping methods. The business appears to have adapted the operation for the omni-channels due to it leveraging the current network for online orders. As a fast fashion value retailer, the supply chain is decoupled at the centralized distribution centre to achieve economies of scale and fast throughput that is customized using the push-pull theory and Just in time distribution for brick and mortar and e-commerce stores. The dispersed landscape and spectrum of cost conscious to convenience focused customers warrants Retailer X offering multiple shipping methods in South Africa and three shipping methods to international customers. Store economy achieved the highest order fulfilment percentage followed by door to door deliveries, store express and postal service in South Africa whilst shipping methods for international orders scored minimal order fulfilment percentages with economy achieving the higher percentage. The results indicate that premium shipping methods are not meeting the SLA in comparison to economy shipping methods. Although the semi-extended strategy may seem like a solution, the start-up and maintenance costs need to be justified by regional volume throughput. Furthermore, the business uses integrated systems in contrast to a cloud based system and does not have visibility of the last mile in the host system. This is a possible contributor to the low order fulfilment percentages for deliveries via store express, door to door and the postal system and possibly also contributes to the inaccuracy from the payment process and duplication of customer services. As a South Africa retailer, Retailer X appears to have adapted the distribution system to manage cost and lead time of stock to customers with the use of semi integrated information systems whilst building a brick and mortar presence internationally.

CHAPTER SEVEN
RECOMMENDATIONS AND CONCLUSIONS

This study was conducted to establish from a demand driven model, whether consumer demand orders need to be frequently fulfilled on time and in full with the use of flexible omni-distribution networks with a real time, highly granular view of inventory across channels from a South African context. The contemporary nature of the topic warranted a case study research of a South African retailer to be undertaken to gain an understanding of how distribution systems have adapted to omni-channel retailing and the effect it has on order fulfilment.

The literature review sought to establish how the omni-channel evolution occurred and the effect it had on traditional distribution systems. Distribution and transporting operations necessitate an enhancement on the traditional model to cater for a seamless shopping experience demanded by customers. Accompanied by a change in supply chain operational processes, inventory management and system advancements are key components in the advancement to omni-distribution. Primary research was undertaken using surveys and questionnaires to establish through empirical findings the effect omni-channel retailing had on a South African retail distribution systems as opposed to international retailers. Using the theoretical framework as the foundation, the examination of empirical findings and case study analysis ensured findings specific to the South African outlook.

7.1 The retail landscape

Online buying is evidently slowly gaining momentum in South Africa despite the high cost of broadband. The growth of mobile commerce, competition between cellular providers and provision of free wifi in malls, libraries and certain municipalities through project Isizwe promotes research and shopping through mobile websites and applications as well e-commerce channels. The spectrum of cost conscious and service focus customers in South Africa warrants service offerings that are based on cost and products assortment. However, unlike international companies such as Zara where delivery costs are subsidized by higher price points, the South African value retailer has to be able to minimize costs at the current price point offered to customers. The omni-channel encompasses the management of brick and mortar as well as digital channels to maintain sustainable supply chains.

7.2 Omni-distribution and process management

The diversification of purchase channels offered to customers has proliferated the quantity of distribution channels and fulfilment centres which may result in a multichannel approach being adopted as opposed to an omni-channel if the inventory is managed in silos. The siloed operation is open to obsolete stock, lost sales and high supply chain costs. However, there is also a high investment and infrastructure cost associated with becoming omni-centric (Forrester, 2014). The omni-channel has to consider the following point to become omni-centric rather than a multi-channel retailer:

- Departments need to work together across the supply chain. Silos do not work well if omni-distribution is being adopted.

- The strategic level, business level and operational level planning should manage inventory across channels that will meet demand at the optimum cost.

- Supply chain flexibility is a necessity to minimize the occurrence of the bullwhip effect through demand variability.
    - Near source procurement facilitates shorter turn around times and greater flexibility with suppliers when demand is variable
    - Strategic partnering with suppliers and transporters assists if emergency staging of containers is required
    - Mass customization and delayed differentiation are key drivers in optimizing cost and meeting demand in the leagility strategy. Cross dock processes and advanced allocation and pick logic algorithms accompanied by innovative sortation, picking and label printing technology facilitates mass customization and delayed differentiation.
    - Warehouse location layout and pick profiles impact lead time and cycle time. Departments and stock locations need to be strategically set up as to reduce the movement of inventory and warehouse traffic. It should also be easy to manage and shuffle for seasonal peaks.
    - Single location SKUs are needed for discrete picking to ensure faster picking process
    - Daily cycle counts are needed to avoid a mismatch of online inventory and physical inventory in the facility.
    - The outbound should build in redirect processes so that packed stock can be reallocated to a new destination before stock is dispatched to the courier. This is particularly important in highly volatile supply chains as to reduce inventory costs and transhipments costs.

- Vendor management inventory (VMI) is also a possible differentiator if there is a long standing partnership with the vendor and if the volume throughput warrants vendor management with a realized saving. The decision to use VMI is dependent on the distance between the vendor and retailer and how reliable the vendor is. It is likely more useful for global shipments and consolidation centres as network demand expands.

- Inventory distribution is influenced by the distribution network.
    - Centralized distribution achieves global optimization and risk pooling by reducing reduces demand variability by pooling stock in central DC. It is beneficial in an omni-channel as stock managed in a central facility and economies of scale are realized. However, the distance to customers lengthens the transit time which becomes problematic when the SLA demands short lead times.
    - A decentralized facility is geographically dispersed which permits near source deliveries and risk diversification (Schmitt, Shen, Snyder and Sun, 2014:2) however, it requires additional management in the omni-channel as there are multiple inbound facilities that suppliers need to deliver to.
    - The Hybrid strategy achieves risk pooling, close to source delivery and transhipment can occur between facilities if there is visibility and information sharing (Simchi-Levi *et al.*, 2008:231). However, there is an associated cost of managing multiple distribution facilities as opposed to a central facility.

The omni-channel requires realized economies of scale and close to source deliveries to minimize cost and achieve order fulfilment. The last mile differentiates the service offering based on the nature of the supply chain.

7.3 The last mile differentiator

The semi-extended strategy and centralized extended strategy appear to suit the South African market and landscape due to the cost efficiency of store collections and the convenience of door to door deliveries. The semi-extended strategy achieved the highest order fulfilment percentage (73.6%) whilst the centralized extended strategy is 55.2 % when order condition is expected to be 83.6% (figure 6.3). The short transit time in the SLA and long distance between the online store and delivery point inhibits on time delivery.

- Near to source distribution necessitates the use of store fulfilment as network inventory is optimized through a central facility and customized for the fulfilment store based on demand using the decoupled strategy.

- The feasibility of managing one fulfilment store in each region becomes more sustainable as volume through the omni-channel grows and the set up and maintenance costs of running store fulfilment becomes viable in the cost model with deliveries be done through the existing network. The cost per unit is cheaper due to high volume throughput and full loads. In the case study, Retailer X requires store fulfilment in regions far from Gauteng such as Northern Cape, Western Cape and Eastern Cape.

- Expansion of store fulfilment to every region and internationally warrants staging and packing space as well as training of fulfilment staff in addition to the set up cost. A cost benefit analysis for each potential regional store is necessary followed by a well-planned out deployment plan if store fulfilment is going to be used in the region.

- Orders should be delivered based on the following routing logic. The use of close to proximity routing logic directs the order to the nearest fulfilment store. In addition, the routing logic should also account for inventory levels at stores, an order limit per day per store, complete shipment from a store, special handling and route selection of the next best store based on the available to promise (ATP) number with the use of a Distribution Order Management System (Sonier (2015:4).

- Although door to door deliveries are the most preferred method of delivery for less cost conscious customers, it is the most problematic since customers are widely dispersed in far outlying regions. The cross subsidization of the transport charge paid by the retailer varies depending on the distance between the online or fulfilment store and the delivery destination; however, customers pay a fixed rate. Lau (2012:648) is of the view that a pricing scheme with a surcharge for various delivery options be used to ensure effective utilization of resources, route optimization and product fulfilment.

- Online orders are processed and delivered based on the first in first out (FIFO) principle to ensure service levels are met. However, the door to door and store express delivery methods achieved 66% and 57% order fulfilment (figure 6.3) which appears to be due to the long intransit times between the online store and delivery destination. If regional store fulfilment is used, demand can be consolidated relative to demand to optimize delivery and operational costs can be reduced for the courier as well as the retailer and customer.

- As a South African retailer, Retailer X is still establishing a global presence and is learning about global fulfilment. The long transit time between countries necessitates a brick and mortar presence as Zara and H & M are doing.

- Overnight deliveries maybe nominated compared to a delivery with a 3 day lead time. The option with the 3 day lead time may utilize the existing network whilst the overnight delivery may require a specialised delivery vehicle which is out of the usual distribution network. The overnight delivery can be done at a higher price point compared to the 3 day delivery. As in the case of Zara which has a service model that is built on faster fulfilment. However, value retailers have a price point target. This strategy maybe become more useful as South African customers become more demanding or as South African retailers extend their global presence to compete with global retailers more aggressively.

The challenge given the South African market is the offset locations outside of the city centres. Outlying customers in remote areas are difficult to fulfil at the best cost option. Woolworths is planning an 80 store roll out for fulfilment which may give them a benefit to fulfil customers' orders. One of the respondents suggested the use of local collection points in addition to the use of instore collections. Partnership between retailer and local petrol station or grocery shop, whereby orders can be delivered by the courier and collected by the customer through using the order number as a unique identifier.

The 100% acquisition of Superbalist and 60% acquisition of Mr Delivery by Takealot allures to need for enhanced logistics capabilities (Cordeur, 2014). Discovery is using Uber to delivery of flu medication. Uber deliveries can be harnessed on a larger scale in the last mile to achieve quick delivery solutions as the need for quicker deliveries increases and the cost of transport decreases. The last mile has a significant impact on service delivery to the customer and cost incurred by the business and customer as it is the final component of the supply chain before the stock reaches the customer. The last mile requires a strategic product fulfilment and transportation plan as well as close collaboration with courier for the SLA to be met and supply chain costs to be managed.

7.4 The contribution of integrated information systems

Seamless integration of information between processes is needed to become an omni-channel, as opposed to the silo effect of multi-channel operations. Cloud based technology and an Order Management Systems need to be utilized to achieve instant synchronization of data, an improvement in supply chain visibility and a higher order fulfilment percentage. Furthermore, the advancement of drone technology, robotics and self-driven vehicles are additional differentiators for a retailer that is an early adopter. However, digitization is accompanied by high investment cost. As a result, Retailer X uses a semi integrated information system. Some of the respondents were of the view that a more unified system would be needed as e-commerce grew. They further suggested that a Distribution Order Management System is needed for real time updates, global stock on hand and stock allocation based on demand and routing.

A delay in data update and lack of visibility of the last mile in the host system is a possible contributor to less informed decision making hence the low order fulfilment percentages for deliveries via store express, door to door and the postal system after the order has been processed. In addition, the associated issues of misrouting the order due to the incorrect postal code being supplied, the delayed timing of EFT payments and the consolidation of orders must not be an oversight in the last mile. The following is needed:

- A validation of the postal code at the point of check out that confirms with the customer the place and expected day of delivery.
- If there has been an EFT payment, the stock should be reserved for the customer and reflect as reserved in the inventory holding until the payment is processed or is declined.
- Split orders should receive a tracking number to match each part of the order and the customer should be made aware of the split order through order track and trace.

The absence of information prohibits decision making. Ideally, end to end visibility is needed, however, as a momentary solution, integration is needed from stakeholders in the last mile to the inventory system to ensure visibility, accountability, traceability and profitability of the last mile operation.

7.5 Conclusion

The study has explored how the South African apparel retailer has adopted omni-distribution in respect of the local landscape. Challenged by the entrance of international retailers and growth of pure play retailers, it has become necessary to provide the customer with a seamless shopping experience whilst managing the associated cost from the proliferation of channels and fulfilment centres in the supply chain. Unlike international counterparts that are servicing a larger online throughput and are able to manage or absorb the cost of distribution due to higher volume, the South African retailer has to create even leaner operation. The use of a centralized DC is beneficial in harnessing cost efficiency through high volume whilst managing inventory for all channels at SKU level through inventory pooling using the omni-distribution approach. The further adoption of delayed distribution manages the volatility of demand by matching supply to demand closer to when demand is known. The use of the leagility strategy attributable to the customer orders decoupling point suits the complex nature of an omni-channel fashion supply chain. Information visibility is necessary through the implementation of a unified system for informed decision making. The last mile is a cost differentiator for brick and mortar and online deliveries. The South African customer base is still in an infancy stage of omni channel retailing, particularly in the case of global retailing. There is a spectrum of cost conscious and convenience focused customers. The additional cost of the omni-channel falls on the customer in the last mile if the retailer is not willing to absorb the cost. A high volume retailer can potentially reduce costs and enhance service levels at the end of the supply chain by employing a well-established logistics network that maximises the brick and mortar network and strategically load plans and utilizes an integrated information system for informed decision making to essentially achieve perfect order fulfilment.

8. ETHICAL CONSIDERATIONS

Ethical clearance has been acquired from the university. Furthermore, gatekeepers' letters were submitted. The participants were treated with respect as they have the right to privacy and to be free from coercion or harm. In addition, the researcher will have to safeguard the privacy of the information (Hair *et al.*, 2007:68). The researcher is entitled to faithful participation and honesty from the participants having gained their consent. The researcher is also entitled to privacy of the details of the procedure (Hair *et al.*, 2007:72-73).

9. LIMITATIONS AND DELIMITATIONS OF THE STUDY

Prior research has not been done on this area of study on the retailer in the case study. Furthermore, there is very little research concerning omni-distribution from a South African context. The use of an exploratory case study with a judgement sampled was deemed most appropriate to gauge detailed information from experienced individuals to overcome this limitation.

10. SIGNIFICANCE OF THE STUDY

The study sought to understand how South African Retailers have adapted their distribution network to fulfil volatile customer orders having adopted omni-channel retailing. The retailer in the case was nominated as it was rated by Deloitte as one of the top ten retailers in Africa with an e-commerce and brick and mortar presence as well as one of the top three retailers in Africa with the highest growth rate (Dennis and Piatti, 2015:25 and 27). The study reveals that there is a lack of visibility of online orders in the last mile which has an implication on order fulfilment and customer service. Retailers like Zara, H & M, Cotton On and Mango are creating a brick and mortar presence in South Africa to gain market share. End to end real time visibility of inventory movement and a customized cost to service transport model is essential for fulfilling demand more competitively.

11. FUTURE STUDIES

The findings of the study emphasizes the significance of the last mile which perpetuates the need for further exploration of distribution order management in the South African landscape. Furthermore, the growth of e-commerce attributable to free Wi-Fi as well as technological advancement postulates a change in South African retail. In addition, the study explored the apparel sector of the retail industry. FMCG is accompanied by shorter lead times whilst Home supply chains are weighed by additional complexity such as volumetric, fragile and multi-item products. The last mile could possibly be an even greater distinguisher in these retail sectors attributable to the nature of the product.

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13. STRUCTURE OF DISSERTATION

The dissertation comprises six chapters. Chapter 1, introduced the study, which is: ***The effect of omni-distribution systems in managing demand order fulfilment frequencies: An Apparel Retailer***. The chapter highlights the research problem, provides a definition of research question and elaborates on the significance of the topic and research approach used for the dissertation. Furthermore, the limitations and assumptions are also highlighted. Chapter 2, the literature review, provides a comprehensive review of prior research and findings. Chapter 3 analyses Retailer X as a case study to assess its order delivery performance against its service level agreement with the customer. Chapter 4 provides a description of the research methodology. Chapter 5 comprises a presentation of results from the fieldwork. Chapter 6 provides an analysis and discussion of the results. Finally, the dissertation concludes with chapter 7 with the proposed recommendations.

14. RESEARCH SCHEDULE (WORK PLAN/TIME-FRAMEWORK)

Month/Year	**Activity**	**Outcome**
April 2015	Preparation of the research proposal	First draft copy
April-May 2015	Review of supervisor's comments	Proposal amended based on supervisor's input
June-July 2015	Final amendments	Ready for formal academic review
October 2015	Literature review and application of ethical clearance	Finalisation of chapter two
October 2015	Research methodology chapter	Chapter four concluded
November 2015– February 2016	Data collection	Raw data collected
March – May 2016	Data compilation and analysis	Establish findings from field study
June – July 2016	Write up and first draft	Completion of first draft
August -September 2016	Submission for examination	Thesis submitted for examination

15. APPENDIX

15.1 Section 1- Research Instruments

15.1.1 Survey Instrument

The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study

1. Welcome to My Survey

Thank you for participating in our survey. Your feedback is important.

UNIVERSITY OF KWAZULU-NATAL
School of Management, IT and Governance

Masters In Commerce- Supply Chain Management
The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study

Researcher: Sanjana Rambaran (073 730 5909)
Supervisor: Dr Patmond T Mbhele (031 260 7524)
Research Office: Ms. M Snyman (031 260 8350)

Dear Respondent,

I, Sanjana Rambaran an (M.COM) student, at the School of Management, IT and Governance, of the University of Kwazulu Natal. You are invited to participate in a research project entitled, The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study. The aim of this study is to establish from a demand driven model, whether consumer demand orders need to be frequently fulfilled on time and in full with the use of flexible omni-distribution networks with a real time, highly granular view of inventory across channels from a South African context.

Through your participation I hope to understand how the omni-distrbution network is fulfilling demand on time and in full through the use of multiple channels. The results of the survey are intended to contribute to the body of knowledge. Findings will also assist in understanding what needs to be done by Mr Price Apparel and other South African Retailers similar to Mr Price Apparel to fulfil demand more competitively.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequence. There will be no monetary gain from participating in this survey. Confidentiality and anonymity of records identifying you as a participant will be maintained by the School of Management, IT and Governance, UKZN.

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me or my supervisor at the numbers listed above.

The survey should take you about 20 minutes to complete. I hope you will take the time to complete this survey.

1

The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study

2. Consent

This section of the survey is confidential and is necessary purely for consent. You name will NOT be published with your responses.

* 1. I (Full name below) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire. By entering my name and clicking next I consent to participate in the survey.

FULL NAME:

2. Date of consent of participation

Date / Time DD / MM / YYYY

The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study

3. Administrative section

Questions pertain to your branch and division. Please enter/select the mostappropriate answer.

Section 1- Administrative information

3. Branch name:

4. Branch number:

5. Which department do you belong to:

- ◯ Administration/Sales
- ◯ Stockroom
- ◯ Merchandising
- ◯ Store management

Section 2- Biographic data

6. Your gender:

- ◯ Male
- ◯ Female

7. What is your job level

- ◯ Senior supervisor
- ◯ Junior manager
- ◯ Middle manager
- ◯ Senior manager

8. How many years of work experience do you have in your current position?

- 0-3 years
- 3-6 years
- 6-9 years
- 9 years +

9. How many years of work experience do you have in the retail industry in a supervisory/managerial position?

- 0-5 years
- 5-10 years
- 10-15 years
- 15 years +

5

The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study

4. Investigative section

Section 3- General understanding of effects of omni-channel

Please select an option from the list provided by clicking on the box. More than one option may be selected for question 9-11.

10. Mr Price has extended to online channels (website and mobile application), as a result have in store sales increased, decreased or remained unchanged due to customers buying online?

- ○ Increased
- ○ Decreased
- ○ Remained unchanged

11. Select the fulfilment channels managed by your branch

- ☐ In store purchases
- ☐ Customer orders
- ☐ Online orders
- ☐ Replacement of items bought in store
- ☐ Replacement of items bought via customer order
- ☐ Replacement of items bought online

12. Select the purchase channels offer by Mr Price Apparel stores to customers

- ☐ The customer buys online and picks up the order in store
- ☐ Customers buys in store and elects to have the order delivered to their preferred place of delivery
- ☐ The customer buys in store and picks up the order in-store
- ☐ The customer buys online and picks up their order from the post office

13. Select the fulfilment centers that your branch receives stock from

- ☐ Distribution Centers
- ☐ Depots
- ☐ On The Dot
- ☐ Pavillion Store (for online orders)
- ☐ Other stores via IBT (Inter branch transfer)

6

14. Roughly how many instances the customer's order did not arrive on the date of the customer's expectation in the last 6 months?

- ◯ 0-20
- ◯ 21-40
- ◯ 41-60
- ◯ 61-80

15. Roughly how many instances the order did not arrive at the branch**in full (order was incomplete)** in the last 6 months?

- ◯ 0-20
- ◯ 21-40
- ◯ 41-60
- ◯ 61-80

16. Roughly how many instances customer complaints/returns were due to damaged product or packaging of online or customer orders in the last 6 months?

- ◯ 0-20
- ◯ 21-40
- ◯ 41-60
- ◯ 61-80

17. What method/s of communication is being used to notify the customer that their order is ready for pick up?

- ☐ Phone call
- ☐ SMS
- ☐ E-mail
- ☐ Alert on mobile application

18. How many days in advance is your branch informed of the quantity of online and customer orders that will be delivered?

- ◯ 1-2 days
- ◯ 3-4 days
- ◯ 5-6 days
- ◯ 7 days +

19. How do customers commonly track their parcels?

- [ ] Phone call from customer service
- [ ] SMS
- [ ] E-mail
- [ ] Mobile app
- [ ] Website

8

The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study

5. Investigative section

Section 4: Dichotomous questions

Please select either yes or no using the drop down for the statements below.

20. Your branch can successfully undertake picking functions for online channels (website and mobile application) and customer orders in addition to its daily functions

21. Your branch is made aware of the number of orders (online and customer order) that they are expected to receive

22. Your branch has sufficient time to sort online/customer orders before it is due for pick up by the customer

23. Customers have full visibility online of SKUs within individual stores

24. The Redworld POS system provides real time visibility of stock movement at SKU level

25. A Cloud based omni-channel enables the business to respond to demand faster with greater visibility in the business

26. A Cloud based omni-channel provides real time information visibility and processing agility

27. Cloud technology poses a security threat in an omni-channel supply chain

The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study

6. Investigative section

Section 5: The rate to which the frequency and effectiveness of the system fulfils customers' orders

The question below use a scale of 1- 5. 1 is lowfrequency and 5 high frequency. Please select an option from the list provided by clicking on the box.

28. Rate the frequency that orders are delivered viastore economy to your branch

1- Low frequency	2	3	4	5- High frequency
○	○	○	○	○

29. Rate the frequency that orders are delivered viastore express to your branch

1- Low frequency	2	3	4	5- High frequency
○	○	○	○	○

The questions below use a scale of 1- 5. 1 is extremely ineffective and 5 is extremely effective. Please select an option from the list provided by clicking on the box.

30. Rate the extent to which On The Dot is effective at fulfilling all online ordersin full (complete orders)

1- Extremely ineffective	2	3	4	5- Extremely effective	N/A
○	○	○	○	○	○

31. Rate the extent to which On The Dot is effective at fulfilling all online orderson time

1- Extremely ineffective	2	3	4	5- Extremely effective	N/A
○	○	○	○	○	○

32. Rate the extent to which Pavilion is effective at fulfilling all online ordersin full (complete orders)

1- Extremely ineffective	2	3	4	5- Extremely effective	N/A
○	○	○	○	○	○

33. Rate the extent to which Pavilion is effective at fulfilling all online orders on time

1- Extremely ineffective	2	3	4	5- Extremely effective	N/A
○	○	○	○	○	○

Below question uses a scale of 1- 5. 1 is extremely good condition and 5 is extremely bad condition. Please select an option from the list provided by clicking on the box.

34. Rate the condition of the order when it is received into your branch

1- Extremely good condition	2	3	4	5- Extremely bad condition
○	○	○	○	○

The effect of omni-distribution systems in managing demand order fulfilment frequencies: Mr Price Apparel Case Study

7. Investigative section

Section 6: General perceptions on omni-distribution system

The following questions relate to operational performance targets and outcomes after implementing the omni-channel distribution and retailing at Mr Price. Based on your experience and perception, please select an option from the list provided by clicking on one suitable box in for each sub-question, ("1" as strongly disagree, "3" as neutral or neither agree nor disagree, "5" as strongly agree).

* 35.

Electronic Supply Chain Management Systems Integration

	1	2	3	4	5
35.1 The adoption of many retail channels influences the supply chain retail distribution system.	☐	☐	☐	☐	☐
35.2 Customer demand influences 'in full' and 'on time' order fulfilment in the overall distribution system.	☐	☐	☐	☐	☐
35.3 The relative change in demand influences distribution systems in enhancing the order fulfilment lead time and cycle time.	☐	☐	☐	☐	☐
35.4 An integrated information systems improves in full and on time order fulfillment.	☐	☐	☐	☐	☐
35.5 An integrated information systems enhances information sharing and visibility within the virtual distribution network.	☐	☐	☐	☐	☐
35.6 All channels(online and in-store) need to become integrated to provide an excellent customer experience.	☐	☐	☐	☐	☐
35.7 Omni-channel distribution network enhances the logistics customer service on speed and dependability in terms of the order fulfilment process.	☐	☐	☐	☐	☐
35.8 Omni-channel distribution network supports order fulfilment through on time delivery and order fill rate.	☐	☐	☐	☐	☐
35.9 The fast fashion retailing channels require agile supply chains with quick response strategy and shorter cycle times.	☐	☐	☐	☐	☐
35.10 Mr Price Apparel has adapted its distribution network for cross channel buying to fulfil the needs of customers.	☐	☐	☐	☐	☐
35.11 Cloud based technology provides visibility of detailed data in real-time, from various sources across the chain.	☐	☐	☐	☐	☐
35.12 Stock delivered in small frequent loads 'Just in time' reduces inventory holding costs and improves response to changes in demand.	☐	☐	☐	☐	☐
35.13 The omni-distribution system is aimed to pull supply chain activities from demand driven orders to reduce system inventory.	☐	☐	☐	☐	☐
35.14 When demand is unknown and lead time is long, a high fill rate can be achieved by forecasting demand until stock reaches distribution and then distributing stock based on known demand.	☐	☐	☐	☐	☐
35.15 The use of a main distribution centre and multiple smaller distribution facilities benefits mass distribution.	☐	☐	☐	☐	☐
35.16 Online channels provide broader product assortment to customers whilst reducing the risk of being over stocked in one region and under stocked in another as with stores.	☐	☐	☐	☐	☐
35.17 Order Management System unifies order processing across the retailer's distribution network of physical stores.	☐	☐	☐	☐	☐

End of the survey

Thank you for taking time to complete the survey!

13

15.1.2 Semi- structured interview schedule

Questions pertain directly to the research questions in the study

1. What effect has the adoption of omni-channel retailing had on the Mr Price distribution system?

2. How is hybrid distribution contributing towards managing inventory in the network relative to a demand driven omni-channel?

3. How is the omni-distribution network being managed, relative to the growing demand, to achieve perfect order fulfilment (on time, in full and error free deliveries)?

4. How does Mr Price compensate customers for orders that are not perfectly fulfilled?

5. How is cross dock and reserve stock in the dc/fulfilment center used to fulfil demand from various channels?

6. How the JIT levelled distribution scheduling matching supply with demand to ensure customers are given their orders in full and on time?

7. How has MRP Distribution implemented JIT levelled distribution scheduling to reduce lead time?

8. How is automation being used in the distribution facilities to enable quick replenishment and shorter lead times?

9. How does the distribution center layout facilitate the flow of inventory between departments whilst ensuring that cost minimized?

10. What efficiencies are in place to reduce damage from over handling stock?

11. Is the distribution strategy forecast driven, demand driven, or a combination of both?

12. If, forecast driven or combined, how is the bullwhip effect managed? The bullwhip effect is an observed phenomenon in forecast-driven distribution channels. It refers to a trend of larger and

larger swings in inventory in response to changes in customer demand, as one looks at firms further back in the supply chain for a product.

13. How is the decoupled supply chain contributing towards managing cycle time and lead time in an attempt to achieve perfect order fulfilment?

14. What initiatives are in place to increase error free pre-pack and post orders?

15. What route optimization techniques are being used to manage transportation costs and reduce lead time to achieve perfect order fulfilment?

16. Why has there been a shift from using OTD to using store fulfilment?

17. What is the role and significance of information systems in Mr Price's omni-distribution network?

18. How does cloud based omni-channel provide businesses with the capability of responding to demand faster through information visibility and processing agility?

19. What is the effect of using of cloud technology in an omni-channel supply chain and the accompanying security concerns?

20. To what extent a South African retailer, (Mr Price's omni-distribution strategy) can influence the competitive level on a global scale given the logistics and broad band challenges that exist?

End of the interview

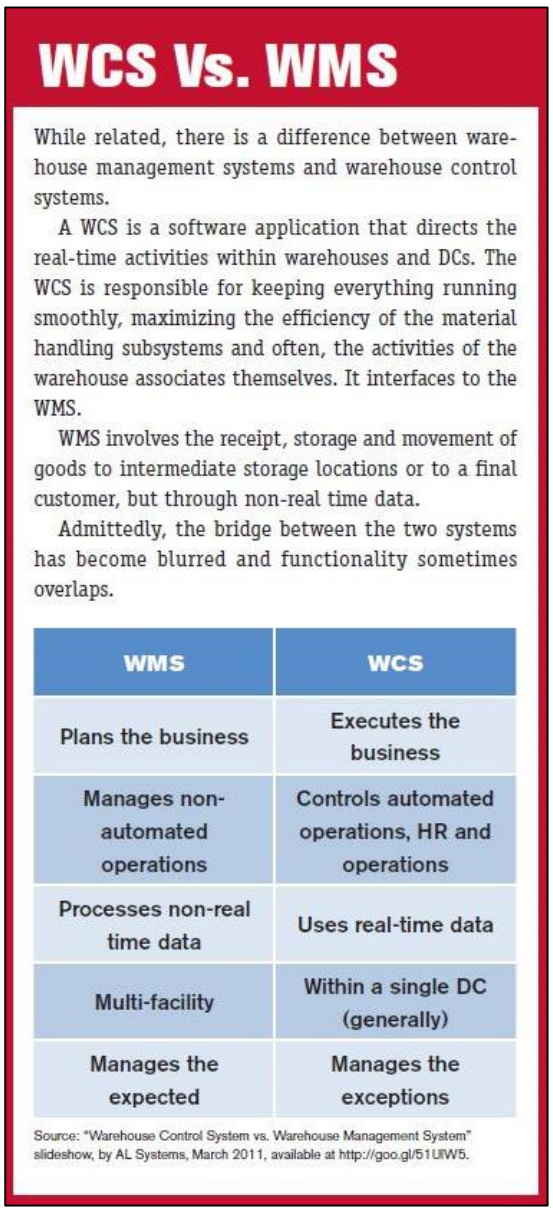
15.2 Section 2- Images

15.2.1 Image 1: Population for quantitative part of the study

Branch name	Branch number	Branch name	Branch number	Branch name	Branch number
Pinetown	102	Port Shepstone	256	Mitchell Plain - Prome	459
Chatsworth	105	Eshowe	259	Cape Gate	467
Kwamnyandu Shopping Centre	107	Greytown	267	Vangate Mall	472
The Wheel	108	Shelly Centre	274	Paarl Mall	473
Windermere	139	Scottsville	277	Mall @ Carnival	474
Pavilion	148	East Rand Mall	283	Worcester - Mount.	476
Phoenix Plaza	149	Southdale	286	Lenasia	477
West Street	155	Bethal	291	Vanderbijl Vaal Mall	481
Amanzimtoti	182	Kokstad	293	Soweto Jabulani	485
Workshop	200	Vereeniging T/rivers	295	Greenstone	487
Bluff	202	The Glen	297	Soweto Maponya	491
Montclair	220	Strand	300	Sebokeng	494
La Lucia	258	Wynberg - Maynard Mall	301	Citrusdal	496
Springfield	261	Belville Cbd	302	Scottsburgh	497
Malvern	284	Voortrekker St Parow	303	Kriel	501
Broadwalk	376	Worcester Cbd	305	Grabouw	505
Queensmead Mall	420	Somerset West	306	Kuilsriver Zevenwach	510
Musgrave	428	Fairbridge Mall	307	Caledon Mill Street	511
Hillcrest	432	Kenilworth - Access Park	308	Howick	515
Gateway	445	Paarl Cbd	314	Ulundi	516
Ballito	456	Kuilsriver	316	Tsakane	519
Umlazi	475	Tyger Valley	319	Soweto Dobsonville	523
Westwood	514	Golden Acre	325	Guguletu	526
Kwa Mashu - Bridge City	528	Somerset Mall	331	Evaton Plaza	530
Davenport Square	554	Springbok	332	Jhb - Kerk Street	533
Watercrest Mall	623	Vredenburg	336	Vosloorus	534
Game City	703	Ceres	339	Bizana	540
Margate	103	Kuilsriver Clearouts	340	Soweto - Protea Garc	542
Alberton City	110	Stellenbosch	342	Nongoma	544
Springs	111	Vredendal	345	Esikhawini Plaza	550
Festival Walk Kempto	117	Bredasdorp	347	Khayelitsha	551
Southgate	130	Wellington	349	PMB - Edendale	553
Brakpan Clearouts	135	Hermanus	352	Edenvale	555
Brixton	152	Cavendish	363	Kathlehong-Chris Har	556
Pmb Church Street	156	Malmesbury	372	Kathlehong-Enoch Sa	558
Goldenwalk Centre	157	Kenilworth Sanlam	374	Soweto Protea Glen	564
Carlton Centre	161	Nigel Plaza	379	Atlantis	567
Jhb Market Str	165	V and A Waterfront	381	Hammersdale Junctio	571
Bedford Centre	169	Newtown Junction	383	Stanger	572
Richards Bay	170	Eyethu Orange Farm Mall	384	Mitchells Plain Westg	574
Sasolburg	184	Mandeni Plaza	386	Krugersdorp Kagiso M	580
Vereeniging	208	Swellendam	400	Umzimkhulu Mall	583
Northmead Mall	211	Canal Walk Century	401	Talis Place Clearouts	600
Eastgate	215	Seapoint Main Road	411	Flagstaff	620
Heidelberg	221	Eerste Rivier	421	Mall Of The South	624
Hillbrow	226	Benoni Lake	425	Lusikisiki Plaza	634
Empangeni	227	Adderley Street	429	Mount Frere Mall	639
Bayside Tableview	228	Piketberg	436	Boksburg Cbd	705
Parow Sanlam	229	Noordhoek Longbeach	443	Rossettenville Centr	706
Mtubatuba	230	N1 City Mall	447	Carlton Centre Kids	738
Daveyton	232	Melville	448	Vangate Mall Kids	776
Matatiele	234	Rosettenville Clearouts	451	Mbabane - Swazi Plaz	811
Kempton Square	241	Blue Route Tokai	452	Manzini - Bhunu Mall	812
East Rand Value	248	PMB - Midlands Mall	457	**Count of stores**	**161**

Source: Retailer X, 2015

15.2.2 Image 2: Difference between WCS and WMS



WCS Vs. WMS

While related, there is a difference between warehouse management systems and warehouse control systems.

A WCS is a software application that directs the real-time activities within warehouses and DCs. The WCS is responsible for keeping everything running smoothly, maximizing the efficiency of the material handling subsystems and often, the activities of the warehouse associates themselves. It interfaces to the WMS.

WMS involves the receipt, storage and movement of goods to intermediate storage locations or to a final customer, but through non-real time data.

Admittedly, the bridge between the two systems has become blurred and functionality sometimes overlaps.

WMS	WCS
Plans the business	Executes the business
Manages non-automated operations	Controls automated operations, HR and operations
Processes non-real time data	Uses real-time data
Multi-facility	Within a single DC (generally)
Manages the expected	Manages the exceptions

Source: "Warehouse Control System vs. Warehouse Management System" slideshow, by AL Systems, March 2011, available at http://goo.gl/51UlW5.

Source: Cited by Alexander, World Trade. Omni-tasking for omni-channels. 2014. [Online]. Available: http://connection.ebscohost.com/c/articles/94059082/omni-tasking-omni-channels [22 August 2015]

15.2.3 Image 3: Interview schedule- Guide for establishing interview questions

Types of questions	Purpose of questions	Some examples
1. Introducing questions	To kick start the conversation and move to the main interview	"Can you tell me about [. . .]?" "Do you remember an occasion when [. . .]?" "What happened in the episode mentioned?"
2. Follow-up questions	To direct questioning to what has just been said	Nodding, "mm", Repeating significant words
3. Probing questions	To draw out more complete narratives	"Could you say something more about that?" "Can you give a more detailed description of what happened?" "Do you have further examples of this?"
4. Specifying questions	To develop more precise descriptions from general statements	"What did you think then?" "What did you actually do when you felt a mounting anxiety?" "How did your body react?"
5. Direct questions	To elicit direct responses	"Have you ever received money for good grades?" "When you mention competition, do you then think of a sportsmanlike or a destructive competition?"
6. Indirect questions	To pose projective questions	"How do you believe other pupils regard the competition of grades?"
7. Structuring questions	To refer to the use of key questions to finish off one part of the interview and open up another, or to indicate when a theme is exhausted by breaking off long irrelevant answers	"I would now like to introduce another topic [. . .]"
8. Silence	To allow pauses, so that the interviewees have ample time to associate and reflect, and break the silence themselves with significant information	
9. Interpreting questions	Similar to some forms of probing questions, to rephrase an interviewee's answer to clarify and interpret rather than to explore new information	"You then mean that [. . . .]?" "Is it correct that you feel that [. . .]?" "Does the expression [. . .] cover what you have just expressed?"
10. Throw away questions	To serve a variety of purposes, i.e. to relax the subject when sensitive areas have been breached	"Oh, I forgot to ask you [. . .]"

Source: Kvale (1996: 133-5). In: Dumay and Qu (2011:249) The qualitative research interview. *Qualitative Research in Accounting & Management, 8(3):238-264.* [Online]. Available: http://www.emeraldinsight.com.ukzn.idm.oclc.org/doi/pdfplus/10.1108/11766091111162070 [02 April 2016].

15.3 Section 3- Data tables

15.3.1 Univariate and bivariate data tables

15.3.1.1 Frequency tables

Table 1: Cronbach Alpha

Reliability Statistics

Cronbach's Alpha	N of Items
.945	61

Table 2: Job level

q7 Job level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Senior supervisor	17	11.5	11.6	11.6
	Junior manager	26	17.6	17.8	29.5
	Middle manager	38	25.7	26.0	55.5
	Senior manager	65	43.9	44.5	100.0
	Total	146	98.6	100.0	
Missing	Blank	2	1.4		
Total		148	100.0		

Table 3: Managerial experience

q9 Managerial experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5 years	48	32.4	32.4	32.4
	5-10 years	44	29.7	29.7	62.2
	10-15 years	34	23.0	23.0	85.1
	15 years +	22	14.9	14.9	100.0
	Total	148	100.0	100.0	

Table 4: Fulfilment channels managed by stores

Table 4.1 - q11.1 In store purchases

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	121	81.8	81.8	81.8
	No	27	18.2	18.2	100.0
	Total	148	100.0	100.0	

Table 4.2 - q11.2 Customer orders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	34	23.0	23.0	23.0
	No	114	77.0	77.0	100.0
	Total	148	100.0	100.0	

Table 4.3 - q11.3 Online orders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	50	33.8	33.8	33.8
	No	98	66.2	66.2	100.0
	Total	148	100.0	100.0	

Table 4.4 - q11.4 Replacement in store

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	41	27.7	27.7	27.7
	No	107	72.3	72.3	100.0
	Total	148	100.0	100.0	

Table 4.5 - q11.5 Replacement customer order

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	24	16.2	16.2	16.2
	No	124	83.8	83.8	100.0
	Total	148	100.0	100.0	

Table 4.6 - -q11.6 Replacement online

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	42	28.4	28.4	28.4
	No	106	71.6	71.6	100.0
	Total	148	100.0	100.0	

Table 4.7- q11-Binomial Test

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
q11.1 In store purchases	Group 1	Yes	121	.82	.50	.000[a]
	Group 2	No	27	.18		
	Total		148	1.00		
q11.2 Customer orders	Group 1	Yes	34	.23	.50	.000[a]
	Group 2	No	114	.77		
	Total		148	1.00		
q11.3 Online orders	Group 1	No	98	.66	.50	.000[a]
	Group 2	Yes	50	.34		
	Total		148	1.00		
q11.4 Replacement in store	Group 1	Yes	41	.28	.50	.000[a]
	Group 2	No	107	.72		
	Total		148	1.00		
q11.5 Replacement customer order	Group 1	No	124	.84	.50	.000[a]
	Group 2	Yes	24	.16		
	Total		148	1.00		
q11.6 Replacement online	Group 1	Yes	42	.28	.50	.000[a]
	Group 2	No	106	.72		
	Total		148	1.00		

a. Based on Z Approximation.

Table 5: Cross channel buying

Table 5.1 - q12.1 Buy online_ pickup instore

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	117	79.1	79.1	79.1
	No	31	20.9	20.9	100.0
	Total	148	100.0	100.0	

Table 5.2 - q12.2 Buys in store and deliver

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	17	11.5	11.5	11.5
	No	131	88.5	88.5	100.0
	Total	148	100.0	100.0	

Table 5.3 - q12.3 Buys and picks up in store

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	58	39.2	39.2	39.2
	No	90	60.8	60.8	100.0
	Total	148	100.0	100.0	

Table 5.4 - q12.4 Buys online and pick from post office

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	27	18.2	18.2	18.2
	No	121	81.8	81.8	100.0
	Total	148	100.0	100.0	

Table 5.5- q12 Binomial Test

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
q12.1 Buy online_ pickup instore	Group 1	Yes	117	.79	.50	.000[a]
	Group 2	No	31	.21		
	Total		148	1.00		
q12.2 Buys in store and deliver	Group 1	No	131	.89	.50	.000[a]
	Group 2	Yes	17	.11		
	Total		148	1.00		
q12.3 Buys and picks up in store	Group 1	No	90	.61	.50	.011[a]
	Group 2	Yes	58	.39		
	Total		148	1.00		
q12.4 Buys online and pick from post office	Group 1	Yes	27	.18	.50	.000[a]
	Group 2	No	121	.82		
	Total		148	1.00		

a. Based on Z Approximation.

Table 6: Fulfilment centres

Table 6.1 - q13.1 Distribution Centers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	136	91.9	91.9	91.9
	No	12	8.1	8.1	100.0
	Total	148	100.0	100.0	

Table 6.2 - q13.2 Depots

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	5.4	5.4	5.4
	No	140	94.6	94.6	100.0
	Total	148	100.0	100.0	

Table 6.3 - q13.3 On The Dot

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	10	6.8	6.8	6.8
	No	138	93.2	93.2	100.0
	Total	148	100.0	100.0	

Table 6.4 - q13.4 Pavillion Store (for online orders)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	9	6.1	6.1	6.1
	No	139	93.9	93.9	100.0
	Total	148	100.0	100.0	

Table 6.5 - q13.5 Other stores via IBT (Inter branch transfer)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	59	39.9	39.9	39.9
	No	89	60.1	60.1	100.0
	Total	148	100.0	100.0	

Table 6.6- q13 Binomial Test

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
q13.1 Distribution Centers	Group 1	Yes	136	.92	.50	.000[a]
	Group 2	No	12	.08		
	Total		148	1.00		
q13.2 Depots	Group 1	No	140	.95	.50	.000[a]
	Group 2	Yes	8	.05		
	Total		148	1.00		
q13.3 On The Dot	Group 1	No	138	.93	.50	.000[a]
	Group 2	Yes	10	.07		
	Total		148	1.00		
q13.4 Pavillion Store (for online orders)	Group 1	No	139	.94	.50	.000[a]
	Group 2	Yes	9	.06		
	Total		148	1.00		
q13.5 Other stores via IBT (Inter branch transfer)	Group 1	Yes	59	.40	.50	.017[a]
	Group 2	No	89	.60		
	Total		148	1.00		

a. Based on Z Approximation.

Table 7: Customer order fulfilment

Table 7.1 - q14 Customer order- On time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-20	136	91.9	96.5	96.5
	21-40	2	1.4	1.4	97.9
	41-60	3	2.0	2.1	100.0
	Total	141	95.3	100.0	
Missing	Blank	7	4.7		
Total		148	100.0		

Table 7.2 - q15 Customer order- In Full

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-20	137	92.6	98.6	98.6
	21-40	1	.7	.7	99.3
	41-60	1	.7	.7	100.0
	Total	139	93.9	100.0	
Missing	Blank	9	6.1		
Total		148	100.0		

Table 7.3 - q16 Customer order- Damage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-20	132	89.2	95.0	95.0
	21-40	4	2.7	2.9	97.8
	41-60	2	1.4	1.4	99.3
	61-80	1	.7	.7	100.0
	Total	139	93.9	100.0	
Missing	Blank	9	6.1		
Total		148	100.0		

Table 8: Communication method with customers

Table 8.1 - q17.1 Phone call

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	5	3.4	3.4	3.4
	No	143	96.6	96.6	100.0
	Total	148	100.0	100.0	

Table 8.2 - q17.2 SMS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	89	60.1	60.1	60.1
	No	59	39.9	39.9	100.0
	Total	148	100.0	100.0	

Table 8.3 - q17.3 E-mail

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	98	66.2	66.2	66.2
	No	50	33.8	33.8	100.0
	Total	148	100.0	100.0	

Table 8.4 - q17.4 Mobile application

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	11	7.4	7.4	7.4
	No	137	92.6	92.6	100.0
	Total	148	100.0	100.0	

Table 8.5- q17 Binomial Test

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
q17.1 Phone call	Group 1	No	143	.97	.50	.000[a]
	Group 2	Yes	5	.03		
	Total		148	1.00		
q17.2 SMS	Group 1	Yes	89	.60	.50	.017[a]
	Group 2	No	59	.40		
	Total		148	1.00		
q17.3 E-mail	Group 1	Yes	98	.66	.50	.000[a]
	Group 2	No	50	.34		
	Total		148	1.00		
q17.4 Mobile application	Group 1	No	137	.93	.50	.000[a]
	Group 2	Yes	11	.07		
	Total		148	1.00		

a. Based on Z Approximation.

Table 9: Store delivery notification

q18 Customer order- notice

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-2 days	92	62.2	66.7	66.7
	3-4 days	35	23.6	25.4	92.0
	5-6 days	2	1.4	1.4	93.5
	7 days +	9	6.1	6.5	100.0
	Total	138	93.2	100.0	
Missing	Blank	10	6.8		
Total		148	100.0		

Table 10: Parcel tracking

Table 10.1 - q19.1 Phone call

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	25	16.9	16.9	16.9
	No	123	83.1	83.1	100.0
	Total	148	100.0	100.0	

Table 10.2 - q19.2 SMS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	62	41.9	41.9	41.9
	No	86	58.1	58.1	100.0
	Total	148	100.0	100.0	

Table 10.3 - q19.3 E-mail

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	91	61.5	61.5	61.5
	No	57	38.5	38.5	100.0
	Total	148	100.0	100.0	

Table 10.4 - q19.4 Mobile app

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	24	16.2	16.2	16.2
	No	124	83.8	83.8	100.0
	Total	148	100.0	100.0	

Table 10.5 - q19.5 Website

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	20	13.5	13.5	13.5
	No	128	86.5	86.5	100.0
	Total	148	100.0	100.0	

Table 10.6- q19 Binomial Test

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
q19.1 Phone call	Group 1	No	123	.83	.50	.000[a]
	Group 2	Yes	25	.17		
	Total		148	1.00		
q19.2 SMS	Group 1	No	86	.58	.50	.058[a]
	Group 2	Yes	62	.42		
	Total		148	1.00		
q19.3 E-mail	Group 1	Yes	91	.61	.50	.006[a]
	Group 2	No	57	.39		
	Total		148	1.00		
q19.4 Mobile app	Group 1	No	124	.84	.50	.000[a]
	Group 2	Yes	24	.16		
	Total		148	1.00		
q19.5 Website	Group 1	Yes	20	.14	.50	.000[a]
	Group 2	No	128	.86		
	Total		148	1.00		

a. Based on Z Approximation.

Table 11: Store function

Table 11.1 - q20 Store function-In-store picking

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	99	66.9	71.7	71.7
	No	39	26.4	28.3	100.0
	Total	138	93.2	100.0	
Missing	Blank	10	6.8		
Total		148	100.0		

Table 11.2 - q21 Store function- Visibility of orders

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	65	43.9	47.1	47.1
	No	73	49.3	52.9	100.0
	Total	138	93.2	100.0	
Missing	Blank	10	6.8		
Total		148	100.0		

Table 11.3 - q22 Store function-order processing time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	117	79.1	84.2	84.2
	No	22	14.9	15.8	100.0
	Total	139	93.9	100.0	
Missing	Blank	9	6.1		
Total		148	100.0		

Table 11.4 - q23 Store function-Customer SKU visibility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	104	70.3	75.4	75.4
	No	34	23.0	24.6	100.0
	Total	138	93.2	100.0	
Missing	Blank	10	6.8		
Total		148	100.0		

Table 11.5 - q24 Store function-System response to demand

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	117	79.1	84.8	84.8
	No	21	14.2	15.2	100.0
	Total	138	93.2	100.0	
Missing	Blank	10	6.8		
Total		148	100.0		

Table 11.6 - q25 Store function-Cloud response to demand

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	120	81.1	88.2	88.2
	No	16	10.8	11.8	100.0
	Total	136	91.9	100.0	
Missing	Blank	12	8.1		
Total		148	100.0		

Table 11.7 - q26 Store function-Cloud SKU visibility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	118	79.7	87.4	87.4
	No	17	11.5	12.6	100.0
	Total	135	91.2	100.0	
Missing	Blank	13	8.8		
Total		148	100.0		

Table 11.8 - q27 Store function-Cloud technology security threat

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	80	54.1	60.6	60.6
	No	52	35.1	39.4	100.0
	Total	132	89.2	100.0	
Missing	Blank	16	10.8		
Total		148	100.0		

Table11.9- Binomial Test

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
q20 Store function-In-store picking	Group 1	Yes	99	.72	.50	.000[a]
	Group 2	No	39	.28		
	Total		138	1.00		
q21 Store function- Visibility of orders	Group 1	Yes	65	.47	.50	.551[a]
	Group 2	No	73	.53		
	Total		138	1.00		
q22 Store function-order processing time	Group 1	No	22	.16	.50	.000[a]
	Group 2	Yes	117	.84		
	Total		139	1.00		
q23 Store function-Customer SKU visibility	Group 1	Yes	104	.75	.50	.000[a]
	Group 2	No	34	.25		
	Total		138	1.00		
q24 Store function-System response to demand	Group 1	Yes	117	.85	.50	.000[a]
	Group 2	No	21	.15		
	Total		138	1.00		
q25 Store function-Cloud response to demand	Group 1	Yes	120	.88	.50	.000[a]
	Group 2	No	16	.12		
	Total		136	1.00		
q26 Store function-Cloud SKU visibility	Group 1	Yes	118	.87	.50	.000[a]
	Group 2	No	17	.13		
	Total		135	1.00		
q27 Store function-Cloud technology security threat	Group 1	Yes	80	.61	.50	.018[a]
	Group 2	No	52	.39		
	Total		132	1.00		

a. Based on Z Approximation.

Table 12: Store delivery- economy and express

Table 12.1 - q28 Store delivery- economy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	13	8.8	9.7	9.7
	2	12	8.1	9.0	18.7
	3	38	25.7	28.4	47.0
	4	34	23.0	25.4	72.4
	5	37	25.0	27.6	100.0
	Total	134	90.5	100.0	
Missing	0	14	9.5		
Total		148	100.0		

Table 12.2 - q29 Store delivery- express

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	21	14.2	15.9	15.9
	2	17	11.5	12.9	28.8
	3	33	22.3	25.0	53.8
	4	32	21.6	24.2	78.0
	5	29	19.6	22.0	100.0
	Total	132	89.2	100.0	
Missing	0	16	10.8		
Total		148	100.0		

Table 13: Store delivery- Online store fulfilment

Table 13.1 - q30 Store delivery- OTD in full

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	1	.7	.7	.7
	2	6	4.1	4.5	5.2
	3	31	20.9	23.1	28.4
	4	23	15.5	17.2	45.5
	5	46	31.1	34.3	79.9
	6	27	18.2	20.1	100.0
	Total	134	90.5	100.0	
Missing	0	14	9.5		
Total		148	100.0		

Table 13.2 - q31 Store delivery- OTD on time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	8	5.4	6.1	6.1
	3	22	14.9	16.7	22.7
	4	28	18.9	21.2	43.9
	5	50	33.8	37.9	81.8
	6	24	16.2	18.2	100.0
	Total	132	89.2	100.0	
Missing	0	16	10.8		
Total		148	100.0		

Table 14: Store delivery- replenishment store

Table 14.1 - q32 Store delivery- Replen store in full

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	4	2.7	3.1	3.1
	2	1	.7	.8	3.9
	3	17	11.5	13.2	17.1
	4	22	14.9	17.1	34.1
	5	35	23.6	27.1	61.2
	6	50	33.8	38.8	100.0
	Total	129	87.2	100.0	
Missing	0	19	12.8		
Total		148	100.0		

Table 14.2 - q33 Store delivery- Replen store on time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	3	2.0	2.3	2.3
	2	6	4.1	4.7	7.0
	3	14	9.5	10.9	17.8
	4	27	18.2	20.9	38.8
	5	32	21.6	24.8	63.6
	6	47	31.8	36.4	100.0
	Total	129	87.2	100.0	
Missing	0	19	12.8		
Total		148	100.0		

Table 15: Store delivery- order condition

q34 Store delivery-Order condition

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	83	56.1	62.4	62.4
	2	19	12.8	14.3	76.7
	3	10	6.8	7.5	84.2
	4	16	10.8	12.0	96.2
	5	5	3.4	3.8	100.0
	Total	133	89.9	100.0	
Missing	0	15	10.1		
Total		148	100.0		

Table 16: Omni-distribution system

Table 16.1- q35.1 adoption of omni channel on systems

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	4.1	4.9	4.9
	Disagree	6	4.1	4.9	9.8
	Neutral	37	25.0	30.1	39.8
	Agree	31	20.9	25.2	65.0
	Strongly agree	43	29.1	35.0	100.0
	Total	123	83.1	100.0	
Missing	Blank	23	15.5		
	System	2	1.4		
	Total	25	16.9		
Total		148	100.0		

Table 16.2 - q35.2 influence of demand on, on time and infull

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	4.7	5.7	5.7
	Disagree	3	2.0	2.4	8.1
	Neutral	20	13.5	16.3	24.4
	Agree	35	23.6	28.5	52.8
	Strongly agree	58	39.2	47.2	100.0
	Total	123	83.1	100.0	
Missing	Blank	23	15.5		
	System	2	1.4		
	Total	25	16.9		
Total		148	100.0		

Table 16.3 - q35.3 influence of demend on, lead time and cycle time

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	2.7	3.3	3.3
	Disagree	5	3.4	4.1	7.3
	Neutral	34	23.0	27.6	35.0
	Agree	44	29.7	35.8	70.7
	Strongly agree	36	24.3	29.3	100.0
	Total	123	83.1	100.0	
Missing	Blank	23	15.5		
	System	2	1.4		
	Total	25	16.9		
Total		148	100.0		

Table 16.4 - q35.4 impact of info system on, on time and in full

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	2.7	3.3	3.3
	Disagree	5	3.4	4.1	7.4
	Neutral	23	15.5	19.0	26.4
	Agree	40	27.0	33.1	59.5
	Strongly agree	49	33.1	40.5	100.0
	Total	121	81.8	100.0	
Missing	Blank	23	15.5		
	System	4	2.7		
	Total	27	18.2		
Total		148	100.0		

Table 16.5 - q35.5 info system on visibility and info sharing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	4.7	5.7	5.7
	Disagree	7	4.7	5.7	11.4
	Neutral	26	17.6	21.1	32.5
	Agree	38	25.7	30.9	63.4
	Strongly agree	45	30.4	36.6	100.0
	Total	123	83.1	100.0	
Missing	Blank	23	15.5		
	System	2	1.4		
	Total	25	16.9		
Total		148	100.0		

Table 16.6 - q35.6 impact of channel integration on cutomer experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	4.1	4.9	4.9
	Disagree	2	1.4	1.6	6.5
	Neutral	8	5.4	6.5	13.0
	Agree	22	14.9	17.9	30.9
	Strongly agree	85	57.4	69.1	100.0
	Total	123	83.1	100.0	
Missing	Blank	23	15.5		
	System	2	1.4		
	Total	25	16.9		
Total		148	100.0		

Table 16.7 - q35.7 impact of omni-distribution on speed and dependability

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	2.7	3.2	3.2
	Disagree	4	2.7	3.2	6.5
	Neutral	22	14.9	17.7	24.2
	Agree	36	24.3	29.0	53.2
	Strongly agree	58	39.2	46.8	100.0
	Total	124	83.8	100.0	
Missing	Blank	23	15.5		
	System	1	.7		
	Total	24	16.2		
Total		148	100.0		

Table 16.8 - q35.8 omni-distribution supports on time and order fill

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	3.4	4.0	4.0
	Disagree	4	2.7	3.2	7.3
	Neutral	25	16.9	20.2	27.4
	Agree	50	33.8	40.3	67.7
	Strongly agree	40	27.0	32.3	100.0
	Total	124	83.8	100.0	
Missing	Blank	23	15.5		
	System	1	.7		
	Total	24	16.2		
Total		148	100.0		

Table 16.9 - q35.9 fast fashion requires quick response and short cycle times

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	8	5.4	6.5	6.5
	Disagree	3	2.0	2.4	8.9
	Neutral	16	10.8	13.0	22.0
	Agree	35	23.6	28.5	50.4
	Strongly agree	61	41.2	49.6	100.0
	Total	123	83.1	100.0	
Missing	Blank	23	15.5		
	System	2	1.4		
	Total	25	16.9		
Total		148	100.0		

Table 16.10 - q35.10 cross channel buying

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	4.1	4.8	4.8
	Disagree	7	4.7	5.6	10.5
	Neutral	15	10.1	12.1	22.6
	Agree	22	14.9	17.7	40.3
	Strongly agree	74	50.0	59.7	100.0
	Total	124	83.8	100.0	
Missing	Blank	23	15.5		
	System	1	.7		
	Total	24	16.2		
Total		148	100.0		

Table 16.11 - q35.11 cloud based technology visibility

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	4.1	4.9	4.9
	Disagree	5	3.4	4.1	8.9
	Neutral	25	16.9	20.3	29.3
	Agree	41	27.7	33.3	62.6
	Strongly agree	46	31.1	37.4	100.0
	Total	123	83.1	100.0	
Missing	Blank	23	15.5		
	System	2	1.4		
	Total	25	16.9		
Total		148	100.0		

Table 16.12 - q35.12 JIT deliveries on cost and demand

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	9	6.1	7.4	7.4
	Disagree	1	.7	.8	8.2
	Neutral	26	17.6	21.3	29.5
	Agree	32	21.6	26.2	55.7
	Strongly agree	54	36.5	44.3	100.0
	Total	122	82.4	100.0	
Missing	Blank	23	15.5		
	System	3	2.0		
	Total	26	17.6		
Total		148	100.0		

Table 16.13 - q35.13 Pull supply chain reduces stock

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	4.1	4.9	4.9
	Disagree	3	2.0	2.5	7.4
	Neutral	31	20.9	25.4	32.8
	Agree	38	25.7	31.1	63.9
	Strongly agree	44	29.7	36.1	100.0
	Total	122	82.4	100.0	
Missing	Blank	23	15.5		
	System	3	2.0		
	Total	26	17.6		
Total		148	100.0		

Table 16.14 - q35.14 impact of decoupling point on fill rate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	7	4.7	5.7	5.7
	Disagree	6	4.1	4.9	10.6
	Neutral	41	27.7	33.3	43.9
	Agree	26	17.6	21.1	65.0
	Strongly agree	43	29.1	35.0	100.0
	Total	123	83.1	100.0	
Missing	Blank	23	15.5		
	System	2	1.4		
	Total	25	16.9		
Total		148	100.0		

Table 16.15 - q35.15 impact of multiple facilities on mass distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	6	4.1	4.8	4.8
	Disagree	5	3.4	4.0	8.8
	Neutral	28	18.9	22.4	31.2
	Agree	39	26.4	31.2	62.4
	Strongly agree	47	31.8	37.6	100.0
	Total	125	84.5	100.0	
Missing	Blank	23	15.5		
Total		148	100.0		

Table 16.16 - q35.16 risk pooling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	4	2.7	3.2	3.2
	Disagree	3	2.0	2.4	5.6
	Neutral	27	18.2	21.8	27.4
	Agree	31	20.9	25.0	52.4
	Strongly agree	59	39.9	47.6	100.0
	Total	124	83.8	100.0	
Missing	Blank	23	15.5		
	System	1	.7		
	Total	24	16.2		
Total		148	100.0		

Table 16.17 - q35.17 Order management system

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly disagree	5	3.4	4.0	4.0
	Disagree	5	3.4	4.0	8.1
	Neutral	27	18.2	21.8	29.8
	Agree	41	27.7	33.1	62.9
	Strongly agree	46	31.1	37.1	100.0
	Total	124	83.8	100.0	
Missing	Blank	23	15.5		
	System	1	.7		
	Total	24	16.2		
Total		148	100.0		

15.3.1.2 Central tendency and dispersion

Table 17: Store delivery- mean, standard deviation and standard mean error (q28-34)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
q28 Store delivery- economy	134	3.52	1.255	.108
q29 Store delivery- express	132	3.23	1.358	.118
q30 Store delivery- OTD in full	107	4.00	1.019	.098
q31 Store delivery- OTD on time	108	4.11	.980	.094
q32 Store delivery- Pavilion in full	79	4.05	1.085	.122
q33 Store delivery- Pavilion on time	82	3.96	1.094	.121
q34 Store delivery-Order condition	133	1.80	1.221	.106

Table 18: Store delivery- One sample test (q28-34)

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
q28 Store delivery- economy	4.819	133	.000	.522	.31	.74
q29 Store delivery- express	1.986	131	.049	.235	.00	.47
q30 Store delivery- OTD in full	10.154	106	.000	1.000	.80	1.20
q31 Store delivery- OTD on time	11.788	107	.000	1.111	.92	1.30
q32 Store delivery- Pavilion in full	8.608	78	.000	1.051	.81	1.29
q33 Store delivery- Pavilion on time	7.977	81	.000	.963	.72	1.20
q34 Store delivery-Order condition	-11.288	132	.000	-1.195	-1.40	-.99

Table 19: Omni-distribution system- mean, standard deviation and standard mean error (q35)

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
q35.1 adoption of omni channel on systems	123	3.80	1.121	.101
q35.2 influence of demand on, on time and infull	123	4.09	1.116	.101
q35.3 influence of demand on, lead time and cycle time	123	3.84	1.003	.090
q35.4 impact of info system on, on time and in full	121	4.03	1.032	.094
q35.5 info system on visibility and info sharing	123	3.87	1.145	.103
q35.6 impact of channel integration on customer experience	123	4.45	1.034	.093
q35.7 impact of omni-distribution on speed and dependability	124	4.13	1.028	.092
q35.8 omni-distribution supports on time and order fill	124	3.94	1.010	.091
q35.9 fast fashion requires quick response and short cycle times	123	4.12	1.142	.103
q35.10 cross channel buying	124	4.22	1.159	.104
q35.11 cloud based technology visibility	123	3.94	1.089	.098
q35.12 JIT deliveries on cost and demand	122	3.99	1.168	.106
q35.13 Pull supply chain reduces stock	122	3.91	1.076	.097
q35.14 impact of decoupling point on fill rate	123	3.75	1.157	.104
q35.15 impact of multiple facilities on mass distribution	125	3.93	1.094	.098
q35.16 risk pooling	124	4.11	1.038	.093
q35.17 Order management system	124	3.95	1.058	.095

Table 20: Store delivery- One sample test (q35)

One-Sample Test

	Test Value = 3					
					95% Confidence Interval of the Difference	
	t	df	Sig. (2-tailed)	Mean Difference	Lower	Upper
q35.1 adoption of omni channel on systems	7.963	122	.000	.805	.60	1.00
q35.2 influence of demend on, on time and infull	10.824	122	.000	1.089	.89	1.29
q35.3 influence of demend on, lead time and cycle time	9.259	122	.000	.837	.66	1.02
q35.4 impact of info system on, on time and in full	11.008	120	.000	1.033	.85	1.22
q35.5 info system on visibility and info sharing	8.427	122	.000	.870	.67	1.07
q35.6 impact of channel integration on cutomer experience	15.524	122	.000	1.447	1.26	1.63
q35.7 impact of omni-distrbution on speed and dependability	12.232	123	.000	1.129	.95	1.31
q35.8 omni-distribution supports on time and order fill	10.313	123	.000	.935	.76	1.12
q35.9 fast fashion requires quick response and short cycle times	10.894	122	.000	1.122	.92	1.33
q35.10 cross channel buying	11.704	123	.000	1.218	1.01	1.42
q35.11 cloud based technology visibility	9.607	122	.000	.943	.75	1.14
q35.12 JIT deliveries on cost and demand	9.381	121	.000	.992	.78	1.20
q35.13 Pull supply chain reduces stock	9.342	121	.000	.910	.72	1.10
q35.14 impact of decoupling point on fill rate	7.173	122	.000	.748	.54	.95
q35.15 impact of multiple facilities on mass distribution	9.486	124	.000	.928	.73	1.12
q35.16 risk pooling	11.944	123	.000	1.113	.93	1.30
q35.17 Order management system	10.015	123	.000	.952	.76	1.14

15.3.1.3 Data tables for hypothesis testing

Table 21: Sales

q10 Sales

	Observed N	Expected N	Residual
Increased	89	47.7	41.3
Decreased	21	47.7	-26.7
Remained unchanged	33	47.7	-14.7
Total	143		

Test Statistics

	q10 Sales
Chi-Square	55.273[a]
df	2
Asymp. Sig.	.000

Table 22: Cross channel fulfilment- fulfilment channels

Table 22.1 -Group Statistics

	Single/Multilpe	N	Mean	Std. Deviation	Std. Error Mean
number channels	Single channel	90	1.51	1.073	.113
	Multiple channels	51	3.29	1.770	.248

Table 22.2 - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
number channels	Equal variances assumed	27.108	0	-7.451	139	0	-1.783	0.239	-2.256	-1.31
	Equal variances not assumed			-6.546	71.269	0	-1.783	0.272	-2.326	-1.24

Table 23: Cross channel fulfilment- fulfilment centres

Group Statistics

	Single/Multilpe	N	Mean	Std. Deviation	Std. Error Mean
number fulfilment centres	Single channel	90	1.22	.536	.056
	Multiple channels	51	2.14	.800	.112

23.2 - Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
number fulfillment centres	Equal variances assumed	7.407	0.007	-8.111	139	0	-0.915	0.113	-1.138	-0.692
	Equal variances not assumed			-7.29	75.869	0	-0.915	0.126	-1.165	-0.665

Table 24: Customer order fulfilment

Frequencies

	q14 Customer order- On time			
	Category	Observed N	Expected N	Residual
1	0-20	136	35.3	100.8
2	21-40	2	35.3	-33.3
3	41-60	3	35.3	-32.3
4		0	35.3	-35.3
Total		141		

Frequencies

	q15 Customer order- In Full			
	Category	Observed N	Expected N	Residual
1	0-20	137	34.8	102.3
2	21-40	1	34.8	-33.8
3	41-60	1	34.8	-33.8
4		0	34.8	-34.8
Total		139		

Frequencies

	q16 Customer order- Damage			
	Category	Observed N	Expected N	Residual
1	0-20	132	34.8	97.3
2	21-40	4	34.8	-30.8
3	41-60	2	34.8	-32.8
4	61-80	1	34.8	-33.8
Total		139		

Test Statistics

	q14 Customer order- On time	q15 Customer order- In Full	q16 Customer order- Damage
Chi-Square	384.078[a]	401.173[b]	363.014[b]
df	3	3	3
Asymp. Sig.	.000	.000	.000

Table 25: Store delivery notification

q18 Frequencies

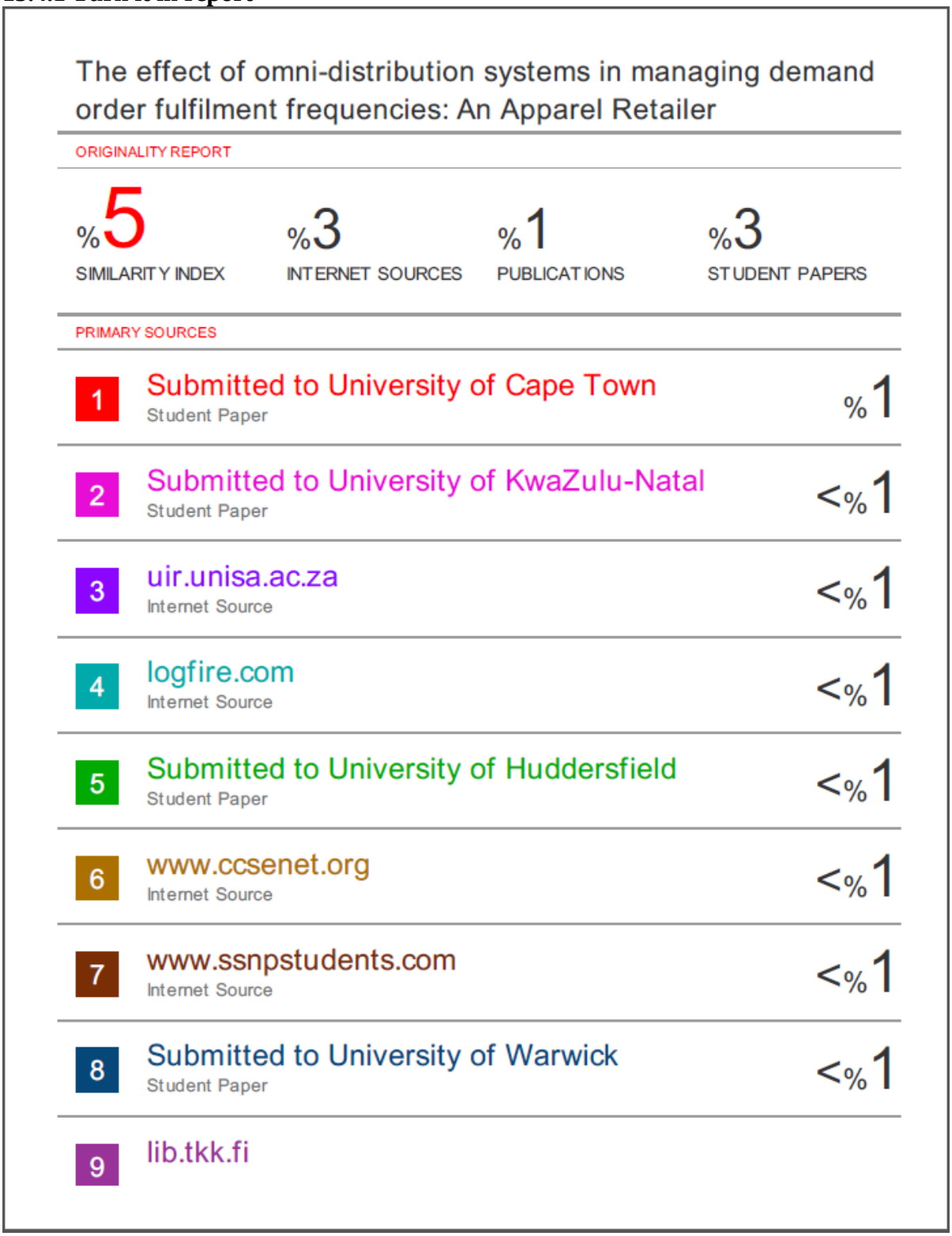
	q18 Customer order- notice			
	Category	Observed N	Expected N	Residual
1	1-2 days	92	34.5	57.5
2	3-4 days	35	34.5	.5
3	5-6 days	2	34.5	-32.5
4	7 days +	9	34.5	-25.5
Total		138		

Test Statistics

	q18 Customer order- notice
Chi-Square	145.304[a]
df	3
Asymp. Sig.	.000

15.4 Section 4- documentation

15.4.1 Turn it in report



The effect of omni-distribution systems in managing demand order fulfilment frequencies: An Apparel Retailer

ORIGINALITY REPORT

%5	%3	%1	%3
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to University of Cape Town Student Paper	%1
2	Submitted to University of KwaZulu-Natal Student Paper	<%1
3	uir.unisa.ac.za Internet Source	<%1
4	logfire.com Internet Source	<%1
5	Submitted to University of Huddersfield Student Paper	<%1
6	www.ccsenet.org Internet Source	<%1
7	www.ssnpstudents.com Internet Source	<%1
8	Submitted to University of Warwick Student Paper	<%1
9	lib.tkk.fi	

15.4.2 Ethical clearance letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

23 September 2016

Ms Sanjana Rambaran (207502996)
School of Management, IT & Governance
Westville Campus

Dear Ms Rambaran,

Protocol reference number: HSS/1805/015M
New project title: The effect of omni-distribution systems in managing demand order fulfilment frequencies: An Apparel Retailer

Approval Notification – Amendment Application

This letter serves to notify you that your application and request for an amendment received on 29 August 2016 has now been approved as follows:

- Change in Title

Any alterations to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form; Title of the Project, Location of the Study must be reviewed and approved through an amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for period of 3 years from the date of original issue. Thereafter Recertification must be applied for on an annual basis.

Best wishes for the successful completion of your research protocol.

Yours faithfully

Naidoo

Dr Shamila Naidoo (Deputy Chair)

/ms

Cc Supervisor: Dr TP Mbhele
cc Academic Leader Research: Professor Brian McArthur
cc School Administrator: Ms Angela Pearce

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15.4.3 Editors certificate

Language Practitioner/Specialist: Language in Education

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To whom it may concern

Date *7 November 2016*

Re: *Language Practitioner Report*

Student *Sanjana Rambaran*

Dissertation : The effect of omni-distribution systems in managing demand order fulfilment frequencies: An Apparel Retailer

I have had the pleasure of reading the above dissertation submitted for the degree of Master of Public Administration, School of Management, Information Technology and Governance at the College of Law and Management Studies,UKZN, and found the language usage fluent and free of any grammatical inaccuracies.

The work has been read for punctuation, fluency and congruency, and meets the language and stylistic writing at this postgraduate level.

I deem the dissertation acceptable for final admission.

Regards

T. Reddy

7/11/2016