Demand chain planning operations within capacity constraints: Nestlé ZAR

by

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Declaration

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Abstract

Organisations are currently faced with difficulties in effectively aligning demand plans to the volatile environments in which they operate. While operating environments and consumer needs change, capacity capabilities often do not reflect the demand plans. The absence of alignment results in inaccurate forecasts, thus putting the long-term sustainability of a business at risk. The focus and aim of the study is to understand how demand planning operations are aligned with capacity constraints at Nestlé ZAR. A quantitative explorative case study research design is being used and data was collected through a structured self-administered questionnaire in this study. The final sample size is 86, which comprised of employees from Demand and Supply Planning, Finance and Control, Sales and Marketing divisions. The sample includes top management, middle management, first level management and non-management. Data analysis uses descriptive and multivariate statistics. Ethical clearance was obtained from the University Ethics Committee and ethical principles were observed throughout the study.

The study findings show that the organisation of interest in this study was perceived as adhering to capacity planning principles. The majority of the respondents perceived positively the capacity demand planning process. An average of 50% scored 22, which indicated a relatively high positive perception with regards to demand chain principles. The majority of the participants responded positively to the statements that information sharing achieves demand chain coordination and improves collaborative demand planning. An average of 50% scored 24, which indicated a relatively high positive perception with regards to information sharing. The results showed few capacity constraints that were perceived or experienced in this organisation. An average of 50% scored 17 which indicated that a moderate number of participants experience capacity constraints. Although the Spearman correlation did not sure any significant relationship between variables of interest in this study, the findings showed a wide range in the distribution of the responses of the participants in some items.

This study highlighted that there is no one single approach to improving demand chain performance, but it was evident that allowing collaborative demand plans by using quality information shared can reduce impact of capacity constraints and improve planning performance. This study recommended that top management should provide full support to information sharing initiatives to facilitate the demand planning process. A national study to be conducted as this was conducted in one province, with a limited sample size.

Keywords: Demand chain, information sharing, capacity

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CHAPTER ONE
INTRODUCTION

1.1. Introduction

The continually changing market place puts a great deal of pressure on businesses to meet the demands of their customers, while at the same time achieving their projected targets. With increasing competitiveness and fluctuating demand, companies more than ever need to increase their level of accuracy when it comes to demand planning (Grimson and Pyke, 2007:354). If the product is not on the shelf, substitutes are readily available to the customer. Furthermore, if the business plans for more than the market needs, the company absorbs the depreciation and associated costs (Christopher, 2005:56). Increased competitiveness and economic instability result in a continuously fluctuating demand. This places pressure on companies to develop new strategies to improve the level of efficiency in their supply chains while reducing overall costs (Browning and Heath, 2009). While effective capacity planning is one mechanism that can be used to achieve efficiency and reduced costs (Bakke and Hellberg, 1993:254), one of the main challenges of achieving effective demand planning is the capacity constraints (capabilities) within a company.

1.2. Background of study

Demand planning is a mechanism that can keep a company one step ahead (Moon, Mentzer and Thomas, 2000:20). Organisations need to review their operating models to ensure that they are responsive to the increasingly complex demand of business (Loretto, 2014:5). This gives businesses the opportunity to plan and execute in a timely manner in order to meet the customer demand (Kahn and Mentzer, 1996:75). Some businesses, however, are not able to effectively adapt their demand planning operations in line with the constantly evolving world of business, resulting in forecasting that is inaccurate and unclear.

To be effective, demand planning can no longer be simply dependent on forecasting techniques (Armstrong, 1987:593) as a number of other variables also affect the outcomes of the demand plans and therefore need to be considered. One variable to consider in particular is capacity constraints as demand plans are highly dependent on the capacity capabilities (Loretto, 2014:4). Consequently, the constraints that exist within capacity will impact the effectiveness of demand plans, whether negative or positive (Morawetza and Sihna, 2012:26).

One of the main issues is that physical capacity cannot be structurally changed in the short term (Tenhiälä, 2011:69; Olhager and Rudberg, 2002:2338). Consequently, as competitiveness increases exponentially and market requirements change, the current capacity of a business does not always reflect these requirements (Heizer and Render, 2011) in that the capacity is either not fully utilised as a result of lower than expected demand or there is a strain on capacity as demand is higher than the company's capabilities (Vollmann, Berry and Whybark, 2005:122). In both cases, capacity provides constraints that need to be considered in capacity planning as it consequently has an impact on how effective demand plans will be (Vollmann *et al.,* 2005:125).

1.3. Research problem

As the 21st century continues to evolve, the environments in which organisations operate are characterised by increasing competitiveness, globalisation pressures and sustainability requirements. These put pressure on companies to implement strategies to meet the demand with minimal resources and at the lowest cost to the business. However, some organisations experience difficulty in effectively aligning demand planning operations to the volatile environment in which they operate. The lack of alignment is likely to result in unreliable and inaccurate forecasting, ultimately putting the long-term viability of the business at risk. Being able to accurately plan demand in uncertain environments is one of the vital elements to improving supply chain performance, as improper planning can result in increased supply chain costs. To be successful, a business must have reliable plans and accurate forecasts in place, not only to identify potential business opportunities, but also to have the capability to exploit these opportunities. One of the biggest challenges to an organisation is being able to accommodate variability in demand, while at the same time aligning this varying demand with the business's capacity in both the short and long term, as the level of reliability of demand planning can be limited by a company's capacity constraints.

1.4. Research Objectives

The study explores how demand planning operations are aligned with capacity constraints at Nestlé ZAR and the research objectives aim:

- To examine the process of demand planning in determining the capabilities of physical production facilities;

- To establish the extent of sharing demand planning information in improving demand chain performance;
- To determine the effectiveness of collaborative demand planning and forecasting in managing the capability and utilisation of business capacity; and
- To assess the relative effects in the relationship between demand chain planning process, and the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities

1.5. Research questions

- What is the process of demand planning in determining the capabilities of physical production facilities?
- What is the extent of sharing demand planning information to improve demand chain performance?
- How effective is collaborative demand planning and forecasting in managing the capability and utilisation of business capacity?
- What are the relative effects in the relationship between demand chain planning process, and the integration of information sharing and collaborative demand forecasting in maximising production capacity capabilities?

1.6. Theoretical framework

Holistic Demand Planning Framework (HDP)

The Holistic Demand Planning (HDP) theory links both internal and external structures and process in demand planning. These authors have contributed to the development of this theory (Bitran, Haas and Hax (1982), Bitran and Hax (1975), Hax and Golovin (1978) and Hax and Meal (1975)). The Holistic Demand Planning approach has been derived from the Hierarchical Demand Planning Approach (HDPA), first presented by Hax and Meal (1975). The aim of the HDPA was to provide a simpler algorithm that would produce plans for a number of planning levels through different steps, starting with an aggregate plan (Nielsen and Steger-Jensen, 2008:5).

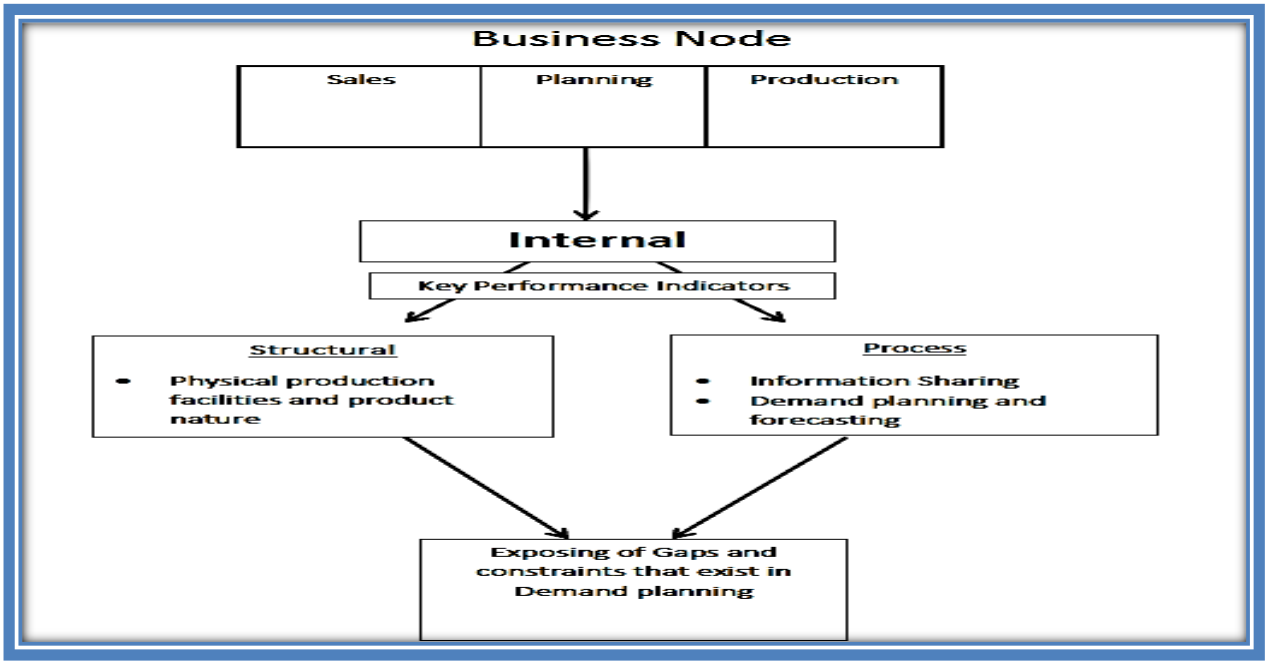
However, various limitations existed in this theory; therefore, Nielsen and Steger-Jensen (2006) developed the Holistic Demand Plan further to tailor demand plans to multiple

perspectives and objectives. These authors proposed that the success of demand planning systems for organisations occur when there is a match between systems, as depicted in Figure 1.1. The process of demand planning should be coordinated by identifying a number of relevant stakeholders, taking into account the external context as well as various objectives, such as sales, manufacturing plans and the business's physical production capabilities (Nielsen and Steger-Jensen, 2006: 6).

The study will borrow from the theory to determine the extent to which demand planning plays a role in determining and managing the organisation's available capacity. The Holistic Framework puts forward a number of factors, both internal and external, affecting demand planning.

The focus for the research will be on the internal elements, mostly on the physical production facilities and nature of the product, information sharing, demand planning and forecasting, considering both structural and process.

Figure 1.1: Holistic Demand Planning Approach



Source: Nielsen and Steger-Jensen (2006)

1.7. Research strategy and techniques

This research combines the use of theoretical framework with field investigations. In order to evaluate the identified research objectives and questions with regards to theoretical framework, the researcher has used journals, articles, relevant books and the Internet. Two main types of research methodologies have been identified: qualitative research and quantitative research. Qualitative research is scientific research approach that seeks to answer the questions the researcher requires responses to, which systematically uses a predefined set of procedures to answer the questions through the collection of evidence. A quantitative enquiry is rooted on the positivist paradigm; a paradigm which applies scientific and logical methods to understand a phenomenon of interest and the data is analyse data statistically (Aliyu, Belo, Kasim and Martin, 2014:83). Based on this the research approach chosen was quantitative.

In quantitative research, data can be analysed using descriptions, which describe the distribution and relationship amongst variables, and inferential statistics, which estimate the degree of confidence that can be placed in generalizations from a sample to the population from which the sample was selected to perform univariate, bivariate and multivariate analysis (Chambliss and Schutt, 2012:155). The study utilises a univariate analysis, as it summarises data by examining: the frequency of distribution; descriptive statistics in the form of measures dispersion (kurtosis); measures of central tendency; the behaviour of a random variable in terms of the degree of peakedness (Wegner, 2007:98). Inferential statistics will only be used to reach conclusions that extend beyond the immediate data.

The non-probability sampling method is the best sampling method for exploratory studies and is also suitable for case studies (Lewis, Saunders and Thornhill, 2009:233). This study therefore used non-probability sampling, where the elements in the population do not have any probabilities associated with being selected as sample subjects (Sekaran and Bougie, 2013:132). It also adopted purposive concenience sampling technique, which involves selecting those participants who are accessible and in the best position to provide the required information on demand planning operations (Sekaran and Bougie, 2013:132).

The SPSS programme was used to analyse the findings. The targeted sample size is 155. The sample will comprise all those who are conveniently available and are fit to participate in the study within Nestle ZAR.

1.8. Validity and reliability

Cronbanch's Alpha coefficient was used to measure reliability. It is an estimate of the internal consistency linked with the scores that can be derived from a scale or a composite score (Cooper and Schindler, 2008:293). Cronbach's Alpha support in determining whether it is justifiable to interpret scores that have been aggregated together. Reliability is important because without it, the scores of the scale may not be valid

1.9.Dissertation structure

Chapter 1: Introduction

A brief introduction and background is provided in this chapter. The information discussed in this chapter is mainly intends to identify: the need for the study, how the study will be conducted through data collection and how the obtained results should be analysed.

Chapter 2: Literature review

The theoretical framework of the study is provided. The concept of demand planning, information sharing and capacity capabilities will be explored. This chapter aims at generating information intended to address the objectives of the study.

Chapter 3: Research methodology

In this chapter, the research methodology used is outlined along with the data collection techniques put into place to generate information. Further to the research methodology and research techniques being outlined, the examiner's choices of data analysis is justified and discussed.

Chapter 4: Data analysis and presentation of results

This chapter features the analysis of results of the data that was captured using a computer software program (SPSS Version 24). That will be used to analyse all the data collected through the data collection instrument (questionnaires). Graphs and tables are used to further illustrate the reduced form of the data output.

Chapter 5: Findings, conclusion and recommendations

Making use of the information generated by the study, finding are summarised and the conclusion is drawn in this chapter. Further to that, recommendations are offered in areas which are deemed necessary after completion of the study.

1.10. Conclusion

In summary, the study focuses on the variables that will assist in understanding Demand chain planning operations within capacity constraints. The study intends to provide insights on ways to improve demand chain performance while reducing the impact of capacity constraints.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

In a knowledge-based economy, organisations should anticipate that operating environments will continue to change. This poses a challenge for many firms as they are confronted with the pressure of effectively aligning demand plans with unsteady environments. As consumer needs change at a rapid rate, capacity requirements limit the competence of an organisation. The capacity capabilities of an organisation do not reflect true demand. The misalignment amongst stakeholders produces inaccurate forecasts, thus causing long term sustainability of businesses to be at risk. This literature review has been guided by several terms, including but not limited to supply chain management, demand chain management, information sharing and capacity. It is based on the fundamentals of the Holistic demand planning framework, focusing on the physical production facilities and nature of the product, information sharing, demand planning and forecasting, considering both structural and process. This framework exposes the gaps and constraints that exist in demand planning.

2.2 Dynamics of Chain Management

Chain management encompasses the concept of managing dimensions of change, it is the streamlining of activities to optimise the value add throughout the chain of activities (Laseter and Oliver, 2003: 21). A number of variables can be described through chain management, commonly known as supply chain, demand chain, information flow and even value chain which is the combination of collaborative activities that deliver optimal value to the end user (Frohlich, 2002:731; Li,Wu and Lai, 2014:265; Tseng and Lin, 2005:69). Through chain management, organisations can obtain the relevant resources to deal with changes in the environment (Wadhwa and Saxena, 2007:437).

2.2.1 Management of Downstream Supply

A key aspect in ensuring that goods are delivered to the end consumer is managing the downstream supply (Supply chain management). Supply Chain Management is a vertical sequence of interdependent transactions that contributes value to the final consumer (Christopher, 2005:65; Lazzarini, Chaddad and Cook, 2001:157). The fundamental element of managing a chain of supply is understanding the value of efficiently integrating suppliers,

manufacturers, warehouses and retailers in order to produce and distribute products/services at the right time, quantities and to the right locations while minimising costs to satisfy customers (Simchi-Levi and Kaminsky (2008:1)). It aims to optimise the total chain of supply, which is highly driven by a need and effective demand planning (Moon *et al.*, 2000:20).

2.2.1.1 Key Challenges in Supply Chain

Key challenges in supply chain management have to do with uncertainty and dynamics of evolving markets (Ivanova, Sokolovb and Dolguic, 2013:2154). The primary activity of a supply chain is receiving input from upstream (a firm's supplier), add value and deliver to customers (Chopra and Meindl, 2010:92). This calls for better understanding of supply chain performance from a dynamic perspective that takes into account efficiency, flexibility and resilience (Klibi, Martel, and Guitouni, 2010; Hahn and Kuhn 2012; Simchi-Levi and Wei 2012; Baghalian, Rezapour and Farahani, 2013).

A supply chain may be designed efficiently despite the existence of risks and the response to disruption being a complex and difficult task (Christopher and Peck, 2004:2; Ponomarov and Holcomb, 2009:127; Pettit, Fiksel and Croxton, 2010:4). Organisations aim to fully integrate supply chains that are competitive yet efficient and responsive to risk and disruptions (Nooraie and Parast, 2015:8). This poses a challenge as there is an inherent risk in global supply chains, concerning demand uncertainty (Chopra and Sodhi, 2004:55; Roh, Hong and Min, 2014:198). Investment in supply chain capabilities can improve the organisation's ability to be more resilient and responsive to disruptions in supply chain, this benefit may be limited by costs associated with it (Juttner, 2005:121; Chopra and Sodhi, 2014:77). Organisations thus need to evaluate cost-benefit of investments in supply chain capabilities to mitigate supply chain risk (Nooraie and Parast, 2015:8).

Supply chain risk management is defined as the creation and implementation of strategies to deal with every day risks as well as exceptional risks throughout the supply chain with intention of reducing vulnerability and warranting business continuity (Zsidisin, Ragatz and Melnyk, 2005:219; Wieland and Wallenburg, 2012:891). Supply chain risk management can be viewed as the ability to be agile; this can be identified as a risk management initiative which assists in rapid response to changes in the market and disruptions in the supply chain (Braunscheidel and Suresh, 2009:121). Therefore, agility in the supply chain is valuable for both mitigation of risk and response to its effects (Lavastre, Gunasekaran and Spalanzani, 2012:830).

Sources of risk are derived from disruptions in supply, demand fluctuations, uncertainty in the environment, capacity limitations (equipment breakdown) and forecast inaccuracies (Harland, Brenchley and Walker, 2003:54; Zsidisin, 2003:219; Chopra and Sodhi, 2004:56; Spekman and Davis, 2004:417). There are two types of supply chain risk, namely: operation risk that is caused by deviations in demand, cost as well as supply; secondly, disruption risks that is as a result of natural and man-made disasters (Tang, 2006:461). Supply chain risk management can be operationalised through business continuity or through a supply chain continuity planning framework (Zsidisin *et al.*, 2005:3407). This can be done through four stages: awareness, prevention, remediation and knowledge management (Zsidisin *et al.*, 2005: 48).

These stages are supported by Hallikas, Virolainen, Pulkkinen and Tuominen (2002:56) who identify that risk management process consists of four stages; Firstly, risk identification, which includes locating, risks, potential damages to the organisation and partners; secondly, risk assessment, which involves determining the level and impact of risks that is measured through financial impact, logistics performance and potential extent of loss; thirdly, risk monitoring and control, this deals with control, containment risk through unplanned reactions in the short, medium and long term. It also involves implementation of preventative measures. Lastly, decision and implementation of the risk management actions which includes risk transference, risk taking, elimination and reduction and continuous analysis of further individual risk.

There have been several attempts to minimise the impact of disruptions on supply chain performance (Nooraie and Parast, 2015: 9). This has been done mainly using deterministic approach to supply chain modelling and analysis (Timpe and Kallrath, 2000:422; Gjerdrum, Shah, and Papageorgiou 2001:84; Azaron, Brown, Tarim and Modarres, 2008:134). However, in supply chains, there are inherent multiple sources of risk and uncertainty (Nooraie and Parast, 2015:9). Therefore, to appropriately assess the impact of supply chain risk on supply chain performance, parameters of demand, cost coefficients and supplies need to be implemented in the stochastic model (Nooraie and Parast, 2015: 9).

2.2.1.2 Approaches to Mitigate Risks and Optimise Management of Supply

A major challenge in supply chain is developing a suitable supply chain design to serve customers in an efficient manner (Poiger, 2010). This poses a growing challenge as organisations are faced with obstacles of shrinking product life cycles, mass customisation of products and increasing uncertainty of demand and supply (Birhanu, Lanka and Rao, 2014:2289). Efficiently handling issues of uncertainty is a major contributor to supply chain

success, as they pose a huge risk to finished goods. Traditionally, the supply chain process has been either push or pull; in recent years a mixed approach of the push-pull system has been developed (Pienaar and Vogt, 2012:59).

A number of authors have used product types to categorise supply chains (Fisher, 1997; Selldin and Olhager, 2007; Wright, 2013). These products can be categorised as functional and innovative products. Wright (2013) and Chopra and Meindl (2007) have a guiding criterion for innovative and functional products, which includes product life cycle, profit margin, product variety as well as lead times. Therefore, in the case of functional products, they would be characterised with long product life cycles, low profit margins, low variety and long lead-times. Whereas innovative products have shorter product life cycles, higher profit margins, increased variety and shorter lead times. This requires a more responsive and agile supply chain as opposed to that of functional products that require efficient and lean supply chains. These values and attributes can thus be used in applying a supply chain strategy (Birhanu *et al.,* 2014:2290).

Birhanu *et al* (2014) found that a company with functional products had a supply chain that is efficient, the product satisfied the basic needs, it was readily available and simultaneously satisfied the following conditions a product life cycle longer than two years, fewer than 20 variants in the product line or family, contribution margins under 20%, and lead time longer than six months (Wright, 2013:589). An organisation that had innovative and highly responsive supply chain had a product life cycle that was no greater than a year, variants above 30, profit margins that were higher that 20% and lead times measured in weeks.

Another measure that can be used to determine the appropriate supply chain strategy is inventory turnover as this indicates operational efficiency in the management of assets (Birhanu *et al.,* 2014:2290). A low rate of inventory turnover indicates presence of obsolesce or deficiencies in products as well as poor marketing efforts. In some cases the low turnover maybe be intentional, where higher turnover rate occurs in the anticipation of increase in prices or shortages in supply from the market. This can be used as a risk hedging tactic and to create agility in a supply chain (Birhanu *et al.,* 2014:2290). On the other hand, a high turnover rate can also highlight inadequate levels of inventory that can lead to loss of sale and result in stock shortages.

Classifications of supply chains can also be based on push and pull strategies (Simchi-Levi, D.and Kaminsky, 2008). These strategies are used for the fulfilment of orders. Push system

centres decisions on long term forecasts where as a pull system is driven by demand (Birhanu *et al.,* 2014:2290). A supply chain is commonly characterised by using a combination of both push and pull where the interface between the two systems is known as a push-pull strategy (Minnich and Maier, 2007: 38). This hybrid strategy constitutes both push element for the component of procurement and an element of pull for production as well as of combined push/pull based on network equilibrium (Olhager, 2003:320). Organisational competences are not only defined by one or both of these strategies, but by exploiting the combined effect of the strategies in order to capitalise on both of their benefits at a lower costs (Birhanu *et al.,* 2014:2290).

2.2.2 Shift from Supply Chain Management to Demand Chain Management

The increase in demand for newer and more innovative products, limited resources, complexity of global market place and heightened expectations from customers has led to the evolution of supply chain management (Simchi-Levi and Kaminsky, 2008:1). Christopher and Ryals (2014: 29) have identified that over the thirty-year history of supply chain, the definition of supply chain management has encouraged focus on supply (production push) rather than a demand pull. These authors argue that there is an emerging case of demand chain management, whereby manufacturing techniques and improved information flow enable the supply chain to run simultaneously with reduced inventory levels and fast consumer response (Christopher and Ryals, 2014: 29).

2.2.2.1 Relevance of Demand Chain Management in Dynamic Operating Environments

Today's fluctuating operating environment places pressure on organisations to react and respond faster to varying customer demands (Vlckova and Patak, 2011:1000). The supply chain has proven to be an efficient way to move stock for the purpose of reaching consumers, but there is still a need to progress towards improved effectiveness (Madhani, 2015:8). Therefore, all that is produced, transferred or handled throughout the supply chain should be in response to an identified consumer requirement (Hilletofth, Ericsson and Christopher, 2009:1181). Ultimately, consumers are the focal point of any value chain, thus these consumers should be the core of any business strategy (Madhani, 2015:8). By doing so, the supply chain is transformed into a demand-driven chain (Langabeer and Rose, 2002) in other words, a demand chain.

Demand chain management is defined as ‘‘a set of practices aimed at managing and coordinating the whole demand chain, starting from the end customer and working backward to raw material supplier’’ (Selen and Soliman, 2002:679). The emphasis is on the needs of the market and developing the chain in a way to meet those needs, opposed to starting with the upstream members and working downstream (Vurala, 2015:264). Demand chain management has become extremely valuable in competitive environments. This means that the focus shifts from employing a one size fits all strategy. Instead, a number of strategies should be developed for each specific product category appropriate to its market condition by combining different supply and distribution strategies (Madhani, 2015:8). Demand chain management creates competitive advantage for an organisation, as it enhances the supply chain’s ability to be more agile in its response to consumer demands.

This concept of demand chain management was first proposed by Vollman and Cordon (1998). These authors identified that the chain should start from customers, which replaces the thinking that focuses on improving purchasing through power of the supplier (Vurala, 2015:264). Vollmann, Cordon, and Heikkilä, (2000) state that supply chain management should be replaced with demand chain management where the emphasis should shift from efficiency of supply flows downstream to responding to customer requirements. The concept of demand chain management can be recognised as a pull strategy where flow in the chain is based on customer requirements, whereas supply chain management is a push strategy highly driven downstream activities to upstream operations (Lee, Ho, Ho and Lau, 2011:5429). Santos and D’Antone (2014) perspective to demand chain management, is that it is an organisation’s dynamic ability of position activities in the market as it changes rapidly. To ensure demand chain management, employment and integration of technology tools is required in order to consolidate demand and share data amongst planning and control functions (Frohlich and Westbrook, 2002:732).

To create a more sustainable environment, a supply chain should be designed from the customer backward, by demand pull (upstream) instead of being from the factory downwards, through supply push (downstream). By doing so organisations can be more responsive to demand and reducing waste and returns (Christopher and Rayls. 2014:29). Companies that are able to link customers and suppliers together into closely integrated networks through demand chain management have been successful (Frohlich and Westbrook, 2002:729).

Demand chain management is a practice that manages and coordinates supply chains from end customers (downstream) backwards to suppliers (upstream) (Vollmann *et al.*, 2000:83). Lummus and Vokurka (1999:17) identify that through demand chain management, actions in the supply chain are triggered by the end customers. Particularly products and services are pulled and not pushed from one link to another based on demand (Lummus and Vokurka, 1999:17). The major challenge is that it requires extensive up and down stream integration amongst supply chain partners (Frohlich and Westbrook, 2002:729).

The shift in supply chains to demand chains is highly driven by market forces and development in new technologies (Christopher and Rayls. 2014:29). Ultimately, power is gradually shifting to downstream, from producers and retailers to buyers and end users. The advancement of technology and the presence of the internet have made this integration a possibility as is has provided access to real time demand information and information visibility (Frohlich and Westbrook, 2002:729)

Integrated business planning is an enabler for much closer alignment of supply and demand (Smith, Andraski and Fawcett, 2011:5; Stank, Esper, Crook, and Autry. 2012:179). Issues arise in supply chains that are poorly coordinated or not integrated (Chong, Ooi, Lin and Tang, 2009:153). Supply chains that are not well integrated or coordinate result in bullwhip effect, where orders to the supplier are at a higher variance than the buyer's sales, this demand distortion moves upstream in an amplified form (Lee, Padmanabhan and Whang, 2004:1882).

Heizer and Render (2011:460) define the bullwhip effect as the increase in fluctuation of orders as they move upstream in the supply chain, the result of this is increased costs associated with inventory, transportation and decreased customer service level and profitability. It is thus important that there is a control in place for the distortion of information as it is amplified moving up the supply chain (Lee *et al.*, 2004:1882).

One way to mitigate this risk is by balancing supply and demand across the supply chain, this requires flow of data between suppliers and buyers that is integrated (Frohlich, 2002:539; Chan and Chan, 2009:2). The integration of demand chain management can deliver at the highest level in operational performance of an organisation (Rexhausen, Pibernik, and Kaiser, 2012:270). Ultimately, the key objectives of demand chain management is managing and understanding along the value chain, by refocusing the supply chain on the demand for products and services downstream (Lun, Lai, Wong and Cheng, 2013: 486).

2.3 Holistic demand planning framework

2.3.1 Hierarchical demand planning approach (HDPA)

The hierarchical demand planning approach is founded on the assumption that there is independence that exists amongst variables, which allows for simpler aggregation and separation of plans and data (Nielsen and Steger-Jensen, 2008:57). Further Hax and Meal (1975:75) based the HDPA on the assumption that the market place is simple and only considers the perspective of manufacturing, planning and control. The aim of the HDPA was to provide a simpler algorithm that would produce plans for a number of planning levels through different steps, starting with an aggregate plan (Nielsen and Steger-Jensen, 2008:5).

2.3.2 Gaps in Hierarchical demand planning approach (HDPA)

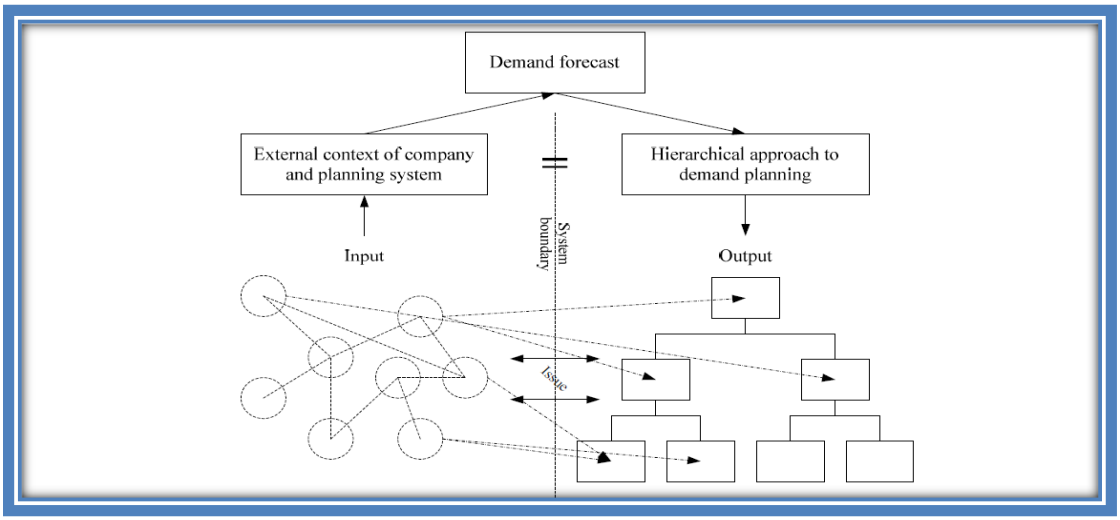
The assumption that indepence exists in variables on planning and marketing only considers manufacturing, planning and control. This assumption was only relevant when the standard was mass production for a single market (Nielsen and Steger-Jensen, 2006:2). These assumptions can no longer hold up in the dynamic world of mass customization and complex buyer-supplier relationships (Nielsen and Steger-Jensen, 2006:2).

The HDPA has a number of planning levels and objects that depend on the utilisation of demand plans (Bitran *et al.,* 1982:237). The downfall thereof is that several planning stages may exist (Bitran *et al.,* 1982:237; Hax and Meal, 1975:80). The planning approach presented by Hax and Meal (1975) is grounded upon the assumption that plans and information can be aggregated and separated within boundaries in an organisation or single business unit without interference (Nielsen and Steger-Jensen, 2008:59).

This however is a limited perspective when considering the complexity of a business unit or an organisation, which was highlighted by Forrester (1958) more than half a century ago. In actuality, organisations are faced with dynamic interaction across several levels both vertically within the company's boundaries and horizontally within the supply network (Nielsen and Steger-Jensen, 2008:59). The consequence of the planning approach is that it underestimates the need to aggregate information and plans across business units or across supply networks (Forrester, 1958:38). Figure 2.1 illustrates the major gaps that exist in the hierarchical demand planning approach. The left area of the figure shows the dynamic and complex external context of demand planning systems. The complexity is mapped through a demand forecast and controlled in a static and modest hierarchical demand planning structure delivering to a

multiple plans on varying control areas, depicted on the right hand side of figure 2.1 (Nielsen and Steger-Jensen, 2006:3). The hierarchical approach is simple and static meanwhile the external context of the organisation is multifaceted and dynamic, consequently, when applying this approach to a complex context, poor performance of the business system should be expected (Nielsen and Steger-Jensen, 2006:3). The second issue at hand in terms of forecasting and demand planning, is that the main focus has been placed on the optimisation on a singular outcome (for example, achieving a specific service-level) (Moon, Mentzer and Smith, 2003). Although this focus is important, there is a need for a broader perspective on the performance of an organisation and designing of a demand planning system. To further highlight the gaps that exists within this approach, researchers.

Figure 2.1: Hierarchical demand planning approach



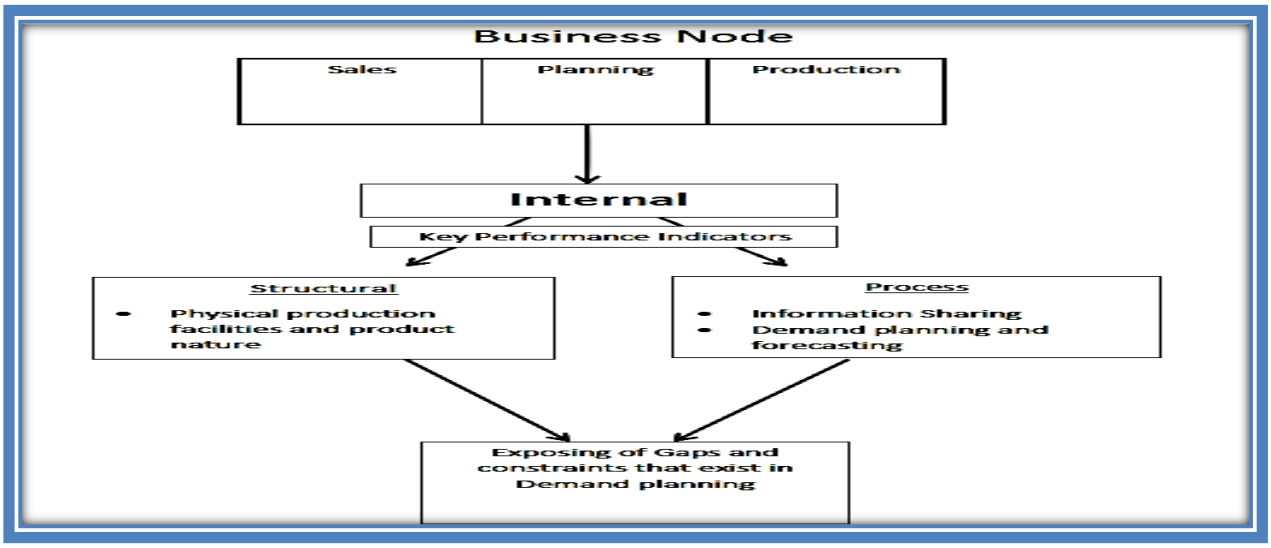
Source: Nielsen and Steger-Jensen (2006)

2.3.3 Development of Holistic demand planning framework (HDPP)

The Holistic Demand Planning approach has been derived from the Hierarchical Demand Planning Approach (HDPA), first presented by Hax and Meal (1975) as a result of the limitations highlighted by a number of authors (Nielsen and Steger-Jensen, 2006; Folan and Browne, 2005; Lapide, 2000). The Holistic Demand Plan, was developed further by Nielsen and Steger-Jensen (2006) to tailor demand plans to multiple perspectives and objectives. These authors proposed that the success of demand planning systems for organisations occur when there is a match between systems. The process of demand planning should be coordinated by identifying a number of relevant stakeholders, taking into account the external context as well

as various objectives, such as sales, manufacturing plans and the business's physical production capabilities (Nielsen and Steger-Jensen, 2006:6). A number of key performance indicators (KPIs) can be used for the evaluation of the performance of the planning process (forecast error, inventory turnover, total production lead time and rescheduling frequency) and these can be compared to the traditional KPIs including profit margins (Nielsen and Steger-Jensen, 2006:6). However, these KPIs can only be used to identify level of performance as the factors influencing these KPIs are not included.

Figure 1.1: Holistic Demand Planning Approach



Source: Nielsen and Steger-Jensen (2006)

2.4 Demand Planning

In business planning, planning for demand is the first step. It is the initial step to subsequent process, including purchasing, production and distribution (Szozda and Werbińska-Wojciechowska, 2013: 77). One of the main issues within supply chain is predicting future demand; typically, the information fed to the upstream is not always what is necessarily required in the downstream. Supply chain performance is largely dependent of the quality of demand plans; the forecasting process is an important element to business success (Szozda and Werbińska-Wojciechowska, 2013: 77).

Demand uncertainty has been highlighted by a number of authors over the decades and extensive research has been done to develop forecasting methods to mitigate this variability (Wemmerlov and Whybark, 1984; Fildes and Beard, 1992; Ho, 1995; Datta and Christopher 2011). This research has identified that there is a relationship between the levels of early

information received and forecasting performance, as well as the amount of investment (Jung and Jeong, 2012:5416).

Triple point technologies (2012) have conducted research on reducing the level of risk in the demand planning process. It states that in the current economic environment, developing a feasible, constrained and profitable demand plan is essential. With the accurate demand plans, manufacturers will only be reliant on the ability to satisfy demand on inefficient building of stock (increasing working capital). The focus is on “just in case” rather than “just in time”.

Inefficiencies in inventory management instantaneously and directly raise costs by using capacity in physical production as well as storage facilities (tpt.com, 2012:5). On the other hand, accurate levels of inventory allows production processes and capacity to be optimally utilised and reduces transitions and setups, furthermore it encourages greater efficiency in areas of logistics (tpt.com, 2012:5).

Demand planning is thus a representation of procedures and information sharing mechanisms used to fully optimise forecast in the demand planning process (Vlckova and Patak, 2011: 1000). Vlckova and Patak (2011) further emphasise that the implementation of demand plans exploits the forecasting planning horizon and improves decisions made on size of production, inventory levels and the utilisation of resources and capacity. This leads to the maximisation of profits in the organisation and along the supply chain. The importance of demand planning is ever so increasing as it is a differentiating factor of customer relationship management and supply chain management (Kilger and Wagner, 2010: 135).

2.5 Collaborative Planning, Forecasting and Replenishment

Collaborative Planning, Forecasting and Replenishment (CPFR) is a base to supply chain multi-sourcing, whereby, market demand, order information and other sources of business intelligence is shared to better the planning efficiency and overall performance of the business (Wang, Tai, and Grover, 2013: 151; Bapna, Barua, Mani and Mehra, 2010: 788). CPFR is generally supported by enterprise resource planning (ERP), it is highly dependent on the information integrity and level of quality that business units provide amongst each other (Gosain, Malhotra, and Sawy, 2004:9). The main element of CPFR is the collaborative activities amongst business units, including demand and supply management which looks at forecasting customer demand at the point of sale and an analysis that involves management

expectation, whereby out-of-bounds conditions are monitored by planning and operations (McAfee and Ashiya, 2003; Wang *et al.*, 2013:154)

The implementation of CPFR may be complex in practice as it requires interchange of extensive data for forecasting a number of varying products (Yao, Kohli, Sherer, and Cederlund, 2013:285). Promotional activities should be accounted for, the period of implementation has to be extended at times and integrate business processes that are not always compatible with CPFR (Doiron, 2004:52). The benefits of CPFR have mainly been measured through modeling approach. One author, Aviv (2002), modeled how partners are able to observe market signals that can improve performance of forecasting. Aviv (2002) determined that the success of implementing CPFR is dependent on the uniqueness of forecasting capabilities of the different partners. In a later study Aviv (2007) identified that the benefits of collaboration are highly dependent on the ability of partners to anticipate demand. The study further suggested that supply chain partners need to agree a reference demand model that all parties can collectively observe. CPFR suggests that organisations need to adapt and accept collaborative systems in order to fully enjoy the benefits (Yao *et al.*, 2013:287).

2.6 Forecasting as an Input to Collaborative Demand Planning

Forecasting for demand has been a major success factor in organisations globally (Chopra and Meindl, 2007:42; Timmermann, 2005:32). Industries such as the fast moving consumable goods (FMCG) and oil are looking for improved accuracy in demand forecasting (Sayed, Gabbar and Miyazaki, 2009: 11662). Research has been limited when it comes to the FMCG industry due to the unreliable forecast, unspecialised planners, and inadequate forecasting techniques and extremely dynamic markets and short term activity planning (Chopra and Meindl, 2007:34).

Sayed *et al* (2009:11662) states that forecasting is an important support to the supply chain process. It is a direct impact to the supply chain and customer service level as well as other key performance indicators such as out of stock, capacity utilization and customer case fill and inventory levels. Therefore, improving the forecasting model can be considered as an important part the overall supply chain process.

Some studies have shown that using combined statistical methods produced improved results as compared to individual methods for both accuracy of forecast and lowering forecast risk (Hibon and Evgeniou, 2005:17). When Smith and Wallis (2005) conducted there research of

using combined methods it showed substantially better results as compared to individual methods used by Clemen (1989). One researcher proposed that a rule-based forecasting technique that combines four extrapolation methods, that is based on predefined rules should be used to analyse time series (Colloby and Armstrong, 1992:1398). This showed better forecasting accuracy, but some simple moving average technique gave better results than this rule-based technique (Sayed *et al.*, 2009:11662).

2.6.1 Developing a Base Forecasting (Statistical Forecasting)

Future demand forecasting is essential to the planning and operation of any organisation on both micro and macro levels (Aye, Balcilar, Gupta and Majumdar, 2015: 67). Forecasting for sales is an essential input for many decision making activities in varying functional areas (Zhang, 2009). The role of statistical forecasting is important in a mature demand planning process when sales performance is fairly stable (tpt.com, 2012:6).

Reliable forecasts can enable the purchasing of certain components using just-in-time as well as timeous and efficient allocation of sufficient manufacturing capacity and resources (Carbonneau, Laframboise and Vahidov, 2008:1141; Huawei, Aimin, and Ruxin, 2012:4; Yan and Ma, 2011:245). Statistical analysis of historical sales can expose trends and seasonality (tpt.com, 2012:6). Statistical forecasting process can be used by firms to automatically evaluate a variety of mathematical forecasting techniques to identify one that is best suited for each item that is forecasted for (tpt.com, 2012:6). Successful organisations leverage both statistical forecasting tools collaboratively with market intelligence to create a solid demand plan.

Madhani (2015:246) identifies that using traditional statistical methodology is no longer suitable as it cannot cope with the growth of market and high access to information. Organisations do not solely rely on statistical forecasts for developing future demand plans. The developed statistical forecast is used as a starting point and input from other key stakeholders is used (human intuition and market intelligence) (tpt.com, 2012:6).

The growing availability of data poses new challenges for these statistical models. These authors recognised three approaches to deal with these challenges. The first approach is concerned with finding the most suitable group of predictors; the second approach establishes a model that is predictive bases on summaries of the predictor variable; the third approach is a penalised L-1 likelihood method that automatically identifies influential variables through continuous shrinkage.

The selection of a group of predictors is commonly used in the dimension reduction methods, this deals with identifying the most significant subset of predictors, which are selected for a larger group of potential predictors in predictive modeling (Madhani (2015: 246). Some challenges arise in the selection of the most influential predictors, therefore heuristic optimisation algorithms have advanced as they include iterative improvement algorithms as well as search methods that are stochastic (Melab, Cahon, Talbi and Duponchel, 2002:204, Meiri and Zahavi, 2006:843)

When forecasting using high dimensional data, the information summary approach is based on the premise that all required information is captured by a lesser number of factors that are common to the predictor variables (Madhani (2015:246). Principal components (PCs) is a popular technique for combining relevant potential predictors into new predictors. Using principal components to summarise data in a forecasting model allows the information in all the predictors to enter into the forecast (Stock and Watson, 2002:1169).

A number of authors (Stock and Watson 2003:790; Forni, Hallin, Lippi, and Reichlin, 2000) find that there is a smaller mean squared error in a forecasted based on diffusion factors as opposed to a simple auto regression and elaborate structural models. The argument against using regression models is that the factors are estimated without considering dependent variables (Madhani (2015:246). Therefore, if only a few factors are reserved to denote the variations of an entire explanatory variable space, there is a possibility that they may not have predictive power for the dependent variable, as the left our factors may be useful (Stock and Watson 2002:1169).

The third approach; Penilised L-1 likelihood has been developed successfully in the last decade to deal with high dimensionality (Madhani (2015:246). This method reduces the sum of squared errors with a sum of absolute values of the coefficients. This approach has been applied over the last few years to a number of problems (Tibshirani, 2011:275).

2.6.2 Accuracy of Forecasting

Commonly, organisations begin with statistical time series forecast, thereafter the business adjusts the figures based on expertise and knowledge (Davydenko and Fildes, 2013:510). This process is executed at a high level of disaggregated stock keeping units (SKUs) (Fildes and Goodwin, 2007:573; Sanders and Ritzman, 2004:515). Empirical evidence shows that judgements under uncertainty is affected by a number of biases/ inefficiencies and usually are

non-optimal (Davydenko and Fildes, 2013:510). The impact of inefficiencies highlights the importance of monitoring accuracy of judgements in demand forecasting (Fildes, Goodwin, Lawrence and Nikolopoulos, 2009:5). The measurement of forecasting accuracy is inseparably linked with the error measure.

Hong, Koo and Kimc (2016:885) states that there are two types of accuracy when evaluating the performance of a forecasting model. Firstly, is estimation accuracy, it identifies to how well the model fits the data at hand. This can be measured using mean squared error (MSE). Secondly, forecasting accuracy, this is deals with proportional error of the actuals versus demand forecast; mean absolute percentage error (MAPE) is the most common measure used to evaluate forecasting accuracy.

2.7 Managing Demand Planning Collaboration Through Reliable Information Sharing

Information exchange is the key to managing physical product flow through the supply chain, as well as reducing costs and improving service performance of enterprises (Wu, Chuang, and Hsu, 2014:125). It is an indispensable tool for survival of businesses and an enabler of supply chain integration (Lotfi, Mukhtar, Sahran, and Zadeh, 2013:298). In a supply chain a prominent dominating issue regarding collaboration is the level and type of information that can be shared amongst partners (Montoya-Torres and Ortiz-Vargas 2014:347).

Although advancements in technology have propelled the opportunity of information sharing, variables of aligned vision amongst planning partners, communication, trust, reciprocity, power amongst members and support from all levels of management need to be considered as influences in the quality of the information shared amongst supply chain partners (Wu *et al.*, 2014:123). In contrast to this Shou, Yang, Zhang, and Su, (2013:2137) explains that in markets that are characterised with abundant opportunity, firms become motivated to share information with partners in order to capture opportunities for market growth.

Low levels of information sharing within companies occur as a result of inefficient coordination of actions amongst business units (Lotfi *et al.,* 2013:298). The greatest value of information sharing is the benefits that are gained, which outweigh the associated costs (Li, Shaw, Sikora, Tan and Yang, 2002:34).

Pandey, Garg and Shankar (2010) developed a framework that identified that the types of information that should be shared include: sales and purchases, inventory levels, product development, sales and forecasting, market development, future plans, costs of production,

technology know how and tracking of orders. A number of (Lotfi *et al.,* 2013: 299; Kocoglu, 2011:1630) authors have identified benefits of information sharing. This includes better understanding of the customer and having the ability to anticipate potential market changes.

Supply chain leaders are currently using information integration to produce significant performance improvements, this includes faster product developments, reduced lead times and higher flexibility in supply (Cachon and Fisher, 2000; Clark and Hammond, 1997; Fawcett, Magnan and McCarter, 2008; Frohlich, 2002; Hong and Rao, 2010; Hult, Ketchen, and Slater, 2004; Radjou, 2003). The focus in the integration of information is on how it can be exploited to transform its benefits into the success of operations in the supply chain and its relationships (Wu, Yeniyurt, Kim and Cavusgil, 2006). Furthermore, on how supply chain partners will respond to the investment returns (Jap and Mohr, 2002).

Historically, integration of information sharing systems emphasised on operational and functional management of problems, for instance equipment location and transportation; management of materials; procurement; distribution as well as inventory management (Geoffrion and Powers, 1995; Scott and Westbrook, 1991; Turner, 1993). During the 1990s this shifted to more technical innovation focus of cellular manufacturing and vendor managed inventory (Black, 1991; Ellinger, Taylor and Daugherty, 1999). To improve the level of competitive advantage, supply chain partners have adopted networking concepts Ho, Au and Newton, 2002).

The integration of information allows for connectivity in the supply chain but does not guarantee the protection of information that is shared (Zhu, Lee, Ho, Hong and Lin, 2014:7). Partners are more willing to provide information on forecast and sales but are hesitant to share on strategic and sensitive information as supply chain members may choose to use it to their advantage (Fawcett, Wallin, Allred and Magnan, 2009:224). The unwillingness to share such information contravene the benefits that arise from investments made for information sharing and relationships as there is unclear decision making quality (Fawcett, Wallin, Allred, and Fawcett, 2011:39).

2.8 Integrating Supply Chain

Collaboration is critical to the success of any supply chain (Chong, Ooi and Sohal, 2009:154). Collaboration in the supply chain is established when there is a level of trust, communication, information sharing and interdependence amongst members of the supply chain (Wu and

Chaung, 2010:304 Chong *et al.,* 2009:315). This collaborative relationship creates the opportunity for supply chain partners to share information on forecast data (Chong *et al.,* 2009:315).

Researchers (Wu and Chuang, 2010; Chong and Ooi, 2008; Chong *et al.,* 2009 and Tsung, 2002) recognised that information sharing and integration the supply chain is a vital prerequisite for a collaborative relationship to be developed. A collaborative relationship is a combination structure that entails a number of relationship attributes such as peer pressure, transaction climate and level of uncertainty (Wu and Chang, 2010:306).

Research has shown that a firm needs to integrate information systems with key supply chain partners in order to facilitate improved information sharing and data exchange (Hult, Ketchen and Arrfelt, 2007:1037). Integration in supply chain has been elevated to a strategic level for competitive advantage that is sustainable. Knowledge sharing can be used to strengthen the effectiveness of organisations' core competencies (Sun, 2013:299)

In an organisation, supply chain integration can achieved between varying levels of internal functions as well as external trading supply chain partners (Lotfi *et al.,* 2013:299). Collaboration requires a collective effort to transform individual goals into a common inclusive goal (Montoya-Torres and Ortiz-Vargas, 2014:346). Particular emphasis is placed on the formation of strategic alliances, cooperation agreements, joint enterprises, virtual integration as well as horizontal, vertical and lateral integration when hoping to achieve collaboration in a supply chain (Soosay, Hyland and Ferrer, 2008:164).

From the view point of Cannella and Ciancimino (2010:6748), it is the transformation of individual sub-optimal solution, into an integrated one, by sharing information on demand and operations those results in collaboration.

The external integration with customers and suppliers is concurrently related to the internal integration commitment to these customers and suppliers (Zhao, Huo, Selen and Yeung, 2011:22). This means that internal integration makes external integration possible through developing capabilities to integrate systems, data and processes, once this has been achieved, external integration can occur (Zhao *et al.,* 2011:22). Information sharing can thus be applied for both internal and external integration (Montoya-Torres and Ortiz-Vargas, 2014; Zhao *et al.,* 2011).

2.9 Creating Visibility in the Chain

Supply chain visibility can be identified as supply chain leaders (the focal company) ability to access or share information on supply chain strategy and operations to its partners (Caridi, Moretto, Perego and Tumino, 2014:2). A number of authors strongly relate supply chain visibility to the efficient interchange of information amongst partners, it should relevant and of value (Kaipia and Hartiala, 2006; McCrea, 2005; Schoenthaler, 2003; Tohamy, 2003). Previous studies have also related it to the exchange of information looking at properties of accuracy, trust, timelessness as well as the usability of the information (Closs, Goldsby and Clinton, 1997; Mohr and Sohi, 1995). Supply chain visibility is able to influence manufacturing, planning, supplying and other activities positively (Lancioni, Smith and Oliva, 2000: 47; Maltz, 2000). Authors Kulp (2002) and Wang and Wei (2007) view on visibility is focused mainly on elements for forecasting, planning, scheduling and execution.

The ultimate role of supply chain visibility is to improve the performance of the organisation, and support the decision making process (Wang and Wei, 2007; Pidun and Felden, 2012). A number of initiatives adopted the notion of performance improvement in order to enable visibility (Choi and Sethi, 2010:5). These initiative include Quick response, efficient consumer response, vendor managed inventory and continuous replenishment (Vaagen, Wallace and Kaut, 2011:223; Marques, Thierry, Lamothe and Gourc, 2010:548).

2.10 Internal Business information sharing / External Information Sharing

With customers becoming increasingly aware of their improved choices and demanding faster response times, shorter product cycle times and competitive products/services, business goals may be difficult to achieve if business units and supply chain partners continue to work in silos (Zhu, Gavirneni, and Kapuscinski, 2010:175). In order for the output of information sharing to be of quality, providing software and hardware is no longer sufficient (Lotfi *et al.*, 2013:300). It requires that participating members be fully willing to partake in the information sharing activities (Rosen, Furst and Blackburn, 2007:305). It has become virtually impossible for organisations to operate alone; they have been networked to a number of partners (Mourtzis, 2011:105).

The role of information sharing is to distribute useful information for people, systems or organisational units (Lotfi *et al.*, 2013:300). To improve the value of information sharing organisations should answer the following questions: Firstly, what to share; secondly, who to

share it with; thirdly, how to share; and lastly when to share. The level of quality of the answers will help reduce or avoid redundancy, the cost of sharing and improve level of responses (Mourtzis, 2011:115)

2.11 Capabilities of Capacity

Capacity is the "throughput or number of units a facility can hold, receive, store or produce in a period of time" (Heizer and Render, 2011:314). One of the main objectives related to planning for capacity is to ensure that the production plans which have been laid out are achievable and will ultimately meet demand requirements (Tenhiälä, 2011:68). Capacity decisions generally determine capital requirements, which take up a share of a company's fixed costs. These decisions also determine whether customer demand will be met or if facilities will remain idle (Heizer and Render, 2011: 315).

In the recent years, fluctuations in demand have pressured organisations to gradually adjust capacity (Morawetz and Sihna, 2012:20). Experts have indicated that this phenomenon continues to grow significantly (Colombier and Geier, 2011:98). As a result of increasing competitiveness and demand, organisation need to adapt their capacity levels of the demand of the customer while delivering on efficient cost structures (Morawetz and Sihna, 2012:20). Firms can continue to expect fluctuations in demand and this cannot be totally levelled (Buhl and Deuse, 2009:26).' This means that continuous adaptation of volume in production and mix is essential to meet requirements for the market (Morawetz and Sihna, 2012:20).

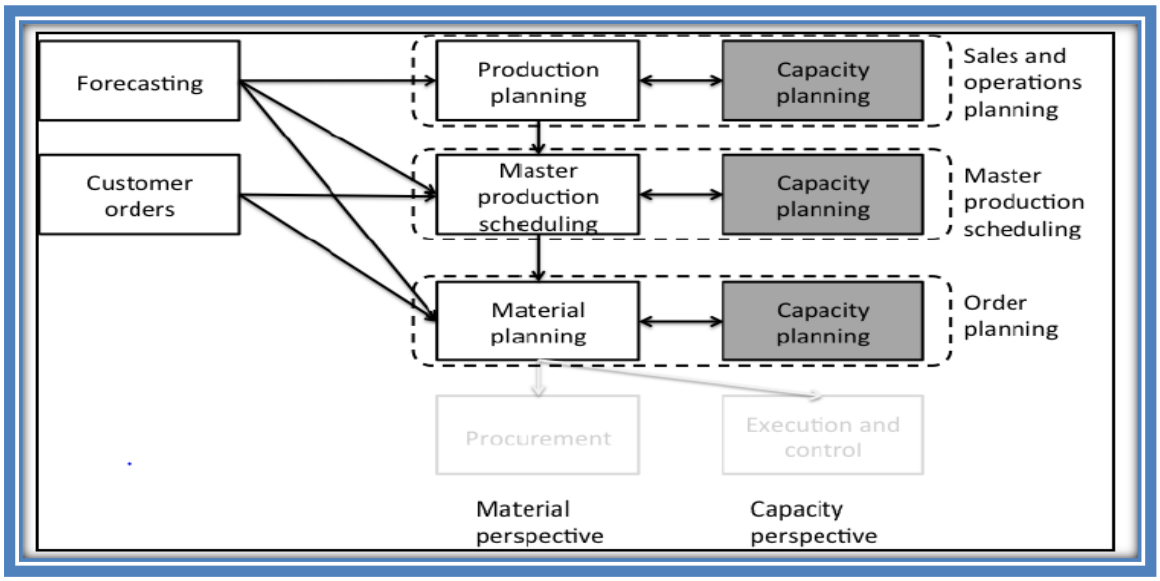
2.11.1 Planning Capacity in the Presence of Uncertainty

Capacity planning is an important for effective strategic planning (Wenming, Jiang, Zhao and Hong, 2014:108). The main purpose of capacity planning is to make decisions for the future in order or to avoid capacity imbalances (Georgiadis and Athanasiou, 2013:48). These decisions could be for short or long term (Heizer and Render, 2011:318). Planning decisions are not only dependent on time horizons but also on the availability and quality of information (Caridi, Crippa, Perego, Sianesi and Tumino, 2010:598).

The parameters of time horizons and information availability can be handled by using hierarchical planning structure of planning levels as seen in figure 2.2 (Jonsson and Mattsson, 2009). The first levels accounts for sales and operations planning, that involves forecasting and production planning. This level has the longest time horizon and highest level of information detail. The second level is the master production scheduling and last level is order planning

which has the shortest time-horizon and lower level of information. (Jonsson and Mattsson, 2009).

Figure 2.2: Planning hierarchy



Source: Jonsson and Mattsson (2009)

2.11.2 Process of Capacity Planning

There are three key identifiable categories to planning for capacity, namely: preconditions for planning; planning hierarchy; and planning cycles, as identified by Johnson and Mattson (2009) and Vollmann *et al* (2005).

The first phase of developing a capacity plan is assessing the preconditions for planning as they identify the possibilities as well as limitations that will balance capacity. Precisely, a number of aspects need to be taken into account when planning for capacity, mainly: the market, demand and people.

Variations in demand and inventory levels are two factors that will define the level of capacity required (Danese and Kalchschmidt, 2011:204). The ability for a firm to priorities these two factors results in improved planning efficiency (Linné and Ekhall, 2013:19). Therefore, it is vital for an organisation to fully understand market requirements and demand (and customer behavior) in the process of planning capacity. Business units are involved in the panning process of capacity, thus it is important that people are able to have trust amongst each other to collaborate and create customer value (Tyler, 2003).

The second step is defining the planning hierarchy that suits the preconditions for planning as capacity imbalances appear in differing time horizons (Linné and Ekhall, 2013). It involves making decisions that will prevent future capacity imbalances. The challenges related to the planning parameters of time and detail can be combated by using hierarchical structure of planning levels as illustrated by Linné and Ekhall (2013), depicting three different levels of capacity planning. These levels should be integrated for the functions of the differing planning levels to work efficiently and cohesively.

The Last step is the planning cycle, the capacity planning that is executed at the differing hierarchical levels is repeated in a fixed frequency, this can be described as cycles. The capacity planning cycle involves five sequential steps, namely production plan, capacity requirements, meetings, actions and capacity plan. The capacity planning is the capacity requirements and capacity plan, while the other steps are necessary as inputs or supporters (Johnson and Mattson, 2009).

2.11.3 Capacity Imbalances

Imbalances in capacity result from unpredicted fluctuations in demand (Linné and Ekhall, 2013: 5). A number of external factors can influence these fluctuations including; Resource constraints, reduction of supply base for raw materials, changed competition or changes in regulations (Johnson and Mattson, 2009:62). Internally, businesses can mitigate this by increasing or decreasing make-to-stock, in order to absorb fluctuations (Christopher, 2005:17).

However, organisations now aim to reduce tied up capital (inventory), consequently the fluctuations are now being absorb by production capacity (Linné and Ekhall, 2013:5). This shift can result in tightened pressure on production capacity and possibly extend the lead times on make-to-order products (Christopher, 2005:19).

Jonsson and Mattson (2009) developed two strategies than can be used for capacity utilisation, the level strategy and the chase strategy as seen in Figure 3. In the Level strategy capacity is utilised equally over time and the stock/ delivery time changes as demand fluctuates. The outcome of this strategy is that production volumes are steady per time periods. The avoidance of capacity changes such as overtime and subcontracting is the greatest benefit that can be identified from this strategy. On the other hand the biggest downfall is that working capital increases. The Chase strategy determines capacity utilisation through demand. Through the use

of this strategy organisations experience advantages and disadvantages opposite of the level strategy

As a result of current business need, organisations opt to reduce the level of inventory in which they hold. This means it is impractical to choose the level strategy in the long-term. Jonsson and Mattson (2009) highlight the importance of the best strategy to be chosen as it influences the businesses decision on how to deal with capacity imbalances.

2.11.4 Flexibility of Capacity in Response to Demand

Capacity flexibility is dependent on plans developed for capacity adjustments during periods of uncertainty and variations in demand (Georgiadis and Athanasiou, 2013; Morawetza and Sihna, 2012). The environment the organisations operate creates a need for capacity to become more and more flexible. Adjusting capacity essentially deals with identifying potential issues early as a result of fluctuations in demand and planning for ways to address fluctuations (Georgiadis and Athanasiou, 2013). This can be done by taking into account adaptation strategies (Morawetza and Sihna, 2012: 22). Morawetza and Sihna (2012) further indicate that capacity plans and adjustments should be aligned to financial cost implication

Georgiadis and Athanasiou (2013) performed a numerical experiment by implementing varying scenarios to capacity planning. These authors compared flexible capacity planning models with near-optimal numerical models that disregarded variability and the downstream of the supply chain. The outcomes for this numerical experiment proposed a flexible dynamic model that can be adapted to demand as it fluctuates. This model deals with uncertainty in sales patterns and inconsistency of quality as well as timing of end product returns. The model is ideal in driving decision making in a situation where potential issues may occur in implementing either a strategy of early large scale investments in order to benefit from economies of scale and capacity readiness, or a strategy of low volume but more frequent capacity expansions.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

In this chapter an overview of the methodology used in the study is outlined. It consist of the research objectives, research approach, research design, research setting, population,, sampling process and sample, data collection tools, data collection process, validity and reliability of data collection tools, data analysis, ethical considerations, data management and dissemination of information . The aim of conducting this study was to explore and describe how demand planning operations are aligned with capacity constraints at Nestlé ZAR and the objectives were:

- To examine the process of demand planning in determining the capabilities of physical production facilities;
- To establish the extent of sharing demand planning information in improving demand chain performance;
- To determine the effectiveness of collaborative demand planning and forecasting in managing the capability and utilisation of business capacity; and
- To assess the relative effects in the relationship between demand chain planning process, and the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities

3.2 Research design

The purpose of a research design is to provide a framework for the collection of data and its analysis (Bryman and Bell, 2004:210). It guides the planning and implementation of a study to ensure that the question of interest is adequately answered (Polit and Beck, 2008:158). The research design reveals how the study prioritises the range of dimensions of the research process (Bryman and Bell, 2004:210). According to Cooper and Schindler (2008:140), the research design can be identified as an activity and time based plan which is derived from the research question. It is a method of selecting the appropriate sources and relevant information.

For the purposes of this study, an explorative case study design was used. The element of this research design is that it is exploratory in nature. Sekaran and Bougie (2013) define exploratory

design as a study where little information or knowledge is available on the phenomenon under investigation or when a new area of a topic is being investigated. Exploratory design is aimed at exploring the full nature of the phenomenon with the purpose of bringing clarity to concepts, identify priorities, improving the research design and cultivating operational definitions (Cooper and Schindler, 2008:145). This design was relevant to this study because the impact of capacity constraints on the outcomes of demand plans is not a widely explored phenomenon and very little literature is available on this topic. In this context, an explorative case study design was a preferred design as it helps explore the full nature of the phenomenon while understanding the underlying issues that exist in the real life context through the Nestlé ZAR case study.

A case study design is a method of investigating a contemporary phenomenon in a real life context (Yin, 2009:26). It allows the researcher to closely examine the phenomenon of interest in within context in which it occurs. A number of researchers (Yin, 2009:26; Patton, 2005:60) have used a case study design to examine real life scenarios in order to provide a foundation for the application of ideas. Researchers may adopt a single case or multiple case design depending on the question that is being explored (Creswell and Tashakkori, 2007). In this study the researcher used a single case design and Nestlé ZAR was used as case. Néstle ZAR was used as a single case because of its unique features as stated in Yin (2009:47). Nestlé is the world's leading nutrition, health and wellness company. Nestlé ZAR has been in existence since the 1870s and is one of the leading companies in consumable goods. It has had a consistently strong market presence and is characterised by ever growing and changing product lines that aim to meet consumer demands. In recent years, however, Nestlé ZAR has been faced with challenges related to capacity, particularly in the form of technical equipment in its top performing stock keeping units that has not been able to meet the demand of its customers. It therefore seemed beneficial to incorporate the case study into the research design as it assisted the researcher in understanding underlying issues in the study.

Yin, Mirrian and Stake (2015:140) outlines four characteristics of a case study design which are considered as essential properties of a case study. According to this authors a case study should be (a) particularistic (focus on particular event, phenomenon or situation), (b) descriptive (the end product of a case study is described indepth, events, articfacts and samples are documented), (c) heuristic (illuminate understanding of the phenomenon by bringing about the discovery of the meaning or confirming what is known) and (d) inductive (rely on inductive

reasoning). These four characteristics outlined above are applicable in this particular study in that this study focuses on demand planning and capacity capabilities and this serve as a boundary for this case study design (particularistic); the end product, which are the results of this study are documented in detail in chapter four (descriptive); understanding and discovery of meaning in the context of this study is addressed in chapter five where the findings are discussed in the context of this study and compared with existing literature confirming what is known or disputing existing evidence (heuristic). Generalisations of findings emerge from an examination of data gathered in the context itself as stated by Yazan (2015:140).

3.3 Research Approach

A quantitative approach was adopted in this study as case study designs may adopt quantitative or qualitative approaches or both as mixed methods approach A quantitative enquiry is rooted on the positivist paradigm; a paradigm which applies scientific and logical methods to understand a phenomenon of interest and the data is analyse data statistically (Aliyu *et al.*, 2014:83). A quantitative approach embraces objective and systematic strategies where the researcher progresses logically through a series of steps, according to a pre-specified plan of action (Sekaran and Bougie, 2013; Brink, Walt and Rensburg, 2006). A quantitative approach makes use of structured procedures and formal instruments to collect data. While numeric information is analysed using statistical procedures (Sekaran and Bougie, 2013; Brink *et al.*, 2006). Quantitative research is able to show relationships that exist between two or more variables; it does not however explain why theses relationship exists (Sale, Lohfeld and Brazil, 2002). A quantitative approach was found appropriate to this study that adopted a systematic process of collecting data, analysed data statically and also intended to establish relationships between variables of interest in this study.

3.4 Study site

Simons (2009) identifies a study site as a physical place where the study will be conducted in order to collect the required data. In a case study design the research takes place in a natural setting; a context within which the phenomenon under study occurs (Yin, 2009). For the purposes of this study, the research was conducted at Nestlé ZAR. Nestlé ZAR has been chosen as the case study and the study will be conducted at Nestlé ZAR Head Offices based in Bryanston, Johannesburg, in the Gauteng region, including its factories and distribution centres.

3.5 Target population

A population is “the entire group of people, events, or things that the researcher desires to investigate” (Sekaran and Bougie, 2013:397). Nestlé ZAR currently has presence in five provinces, including Gauteng, KwaZulu-Natal, Eastern Cape, Western Cape and North West Province. The population included all employees who were working in Gauteng in three Divisions; Demand and Supply Planning (26), Finance and Control (200) and Sales and Marketing (30) at the time of conducting research. Nestlé ZAR at the time of conducting this result had approximately 256 employees and Table 3.1 shows a breakdown of these employes according to their roles in their Divisions. The population was targeted because of their roles as they were directly involved in the formulation and implementation of demand plans.

Table 3.1: Target Population

Province	**Demand Supply Planning**		**Finance and Control**		**Sales and Marketing**		**TOTAL**
Gauteng	**Role**	**No**	**Role**	**No**	**Role**	**No**	
	Demand Planners	4	Sales CCSD	50	Financial Controllers	30	
	Supply Planners	6	Brand Managers	150			
	Inter Market Supply Planners	3					
	Joint Demand and Supply Planners	3					
	Factory Planners	10					
TOTAL		**26**		**200**		**30**	**256**

3.6 Sampling method

A sample can be identified through probability sampling or through non-probability sampling (Sekaran and Bougie, 2013:98). Probability sampling is where each and every element in the population has an equal chance of being selected (Cooper and Schindler, 2008:395). Bryman

and Bell (2004) explain that although this sampling method is random, there is a known chance of selection. Probability sampling can be done through simple random sampling, stratified random sampling, systematic random sampling or random cluster sampling (Bryman and Bell, 2004:102). Non-probability sampling, on the other hand, is where the elements in the population do not have any probabilities associated with being selected as sample subjects (Sekaran and Bougie, 2013:130), which suggests that some units in the population are more likely to be selected than others (Bryman and Bell, 2004:110). Non-probability sampling includes purposive sampling, judgemental sampling, quota sampling, convenience sampling and snowball sampling. In purposive sampling, there is quota and judgemental sampling (Cooper and Schindler, 2008). The purpose of quota sampling is to develop a sample that mirrors a population in terms of the relative proportions of people in different demographic, geographic and socio economic groups (Bryman and Bell, 2004:112. Judgemental sampling is used when a sample must conform to a set of criteria (Cooper and Schindler, 2008:397), while convenience sampling is used when the sample is readily available to the researcher as a result of accessibility (Bryman and Bell, 2004:105).

The non-probability sampling method is the best sampling method for exploratory studies and is also suitable for case studies (Lewis *et al.,* 2009:233). This study therefore used non-probability sampling, where the elements in the population do not have any probabilities associated with being selected as sample subjects (Sekaran and Bougie, 2013:132). It also adopted purposive concenience sampling technique, which involves selecting those participants who are accessible and in the best position to provide the required information on demand planning operations (Sekaran and Bougie, 2013:132). This sampling was appropriate than a systematic approach because it was not easy to access the some of the participants due to the shift system used and that some employees function require them not be stationed in one area.

3.7 Sample Size

A sample is a subset of a population, where particular elements or numbers of elements are selected from the population (Sekaran and Bougie, 2013:241). A Raosoft sample calculator was used to calculate the appropriate sample size. The margin of error was 5% and the level of confidence set at 95%. Of the population of 256 a recommended minimum sample size was 155. This total sample size was also similar to the one suggested in the formula by Sekaran and Bougie (2013)**.**

3.8 Data collection instruments

Data in quantitative studies is gathered through structured questions with items that may be analyses statistically (Polit and Beck, 2008: 156). Hair, Black, Babin and Anderson (2007:156) identify the following three types of questionnaires that can be applied: self-administered questionnaires, interviewer completed questionnaires and observations. Self-administered questionnaires are completed by the respondents (Bryman and Bell, 2004:110). These questionnaires could be distributed either by email, postal or drop off/ pick up. For the purposes of this study, a structured self-administered questionnaires was used. This questionnaire comprised of items that were generated from the reviewed literature (Arunkundrum and Levy, 2012; Croxton, Lambert, García-Dastugue and Rogers, 2002; Li, Biggs and Thies, 2005) under the guidance of the research supervisor. The questionnaire comprised of three sections; Section A collected demographic data; Section two focused on general perceptions on demand chain planning and Section three focused on demand chain principles and information sharing (Annexure 1). The questionnaire had a total of 43 items. Section two had yes or no answers and section three requires participants to respond using a Likert Scale of 1-5 with 1 as Strongly Disagree, 2 as Agree, 3 as Neutral, 4 and Agree and 5 as Strongly Disagree. The questionnaires were identified by numbers per participant and also coded per grouping. Item 5 on the data collection tool on the Job Status/level assisted with the coding per grouping. Completing a questionnaire was estimated to take about 30 to 45 minutes depending on the speed of the participant.

3.8.1 Data Collection Process

The process of data collection began after securing ethics approval from the University Ethics Board and obtaining gatekeeper permission from Néstle ZAR management. The researcher was assisted by managers on duty to have access to the participants, to explain the purpose of the study, request employees to participate in this study and obtain informed consent to those who volunteerd to participate. Questionnaires were distributed to the selected sample, which included all demand planners in each business unit of Nestlé ZAR in Gauteng. The researcher distributed the questionnaires personally but the participants requested time to complete the questionnaire on their own and then submit them to a central place where the researcher can collect them. This processes of data collection took about three months and the response rate was very poor. The researcher had to remind the particpants to complete the qusetionnaires

when they get time and even sent some electronically. Leaving questionnaires and collecting them later is always a challenge according to literure and this results in low response rates.

3.9 Data quality control

It is important to ensure the validity and reliability of any study as they measure the quality of a study and the possibility for similar studies in the future.

Validity is the "evidence that the instrument, techniques or process used to measure a concept do indeed measure the intended concept" (Sekaran and Bougie, 2013:400). During the course of this study, the researcher adopted various tests for validity. One test was content validity, which is related to the sampling adequacy for the construct that is being measured. This type of validity is best for both affective measures and cognitive measures. It was executed by allowing the questionnaire to be scrutinised by experts in demand planning and experts in research methods. The questionnaire was also compared against the objectives of the study to ensure that it appropriately covers the requirements of the study. Items were grouped according to research objectives to ensure that the items aqequately addressed the research objectives.

Reliability refers to the ability of the instrument to provide consistent results over time (Bryman and Bell, 2011:215). It is important to include reliability because in its absence, it makes it difficult to have any validity associated with the scores of the scale. A test-retest reliability was conducted by administering the questionnaire to six managers who were not part of this study. The similar questionnaire was adminsitered twice to the same managers over a period of two weeks. Cronbach's Alpha was used to test for reliability. It is an estimate of the internal consistency linked with the scores that can be derived from a scale or a composite score (Cooper and Schindler, 2008:293). This form of reliability helps to identify whether it is justifiable to interpret scores that have been aggregated together. The responses from the two sets of data were compared and the responses remained consistent, reflecting that the data collection tool was reliable. Responses from item 8 to 43 were compared and scored an Alpha co-efficient of 0.84 which is regarded as acceptable as it is above 0.75

3.10 Data analysis

Data analysis is the process of examining raw data to draw conclusions about this information (Rubin, 2008). A number of statistics can be used to interpret and make sense of raw data collected through quantitative methods (Chambliss and Schutt, 2012:154). In quantitative

studies, data analysis is characterised by the manipulation of numeric data by performing statistical procedures to describe and understand the phenomenon in the study (Trochim, 2008; Polit and Beck, 2008). In quantitative research, data can be analysed using descriptions, which describe the distribution and relationship amongst variables, and inferential statistics, which estimate the degree of confidence that can be placed in generalizations from a sample to the population from which the sample was selected to perform univariate, bivariate and multivariate analysis (Chambliss and Schutt, 2012:155). Univariate analysis is when one variable is analysed at a time, using measurements of central tendency, dispersion and frequency of distribution (Bryman and Bell, 2011:225; Maylor and Blackmon, 2005:328). Bivariate analysis is the analysis of two variables at a time, whereby it is determined whether the two variables are related. Exploring the relationships between the two variables means searching for evidence that the variation in one variable relates with the variation in another (Bryman and Bell, 2011:225). Although bivariate analysis uses number of techniques to examine relationships, its use is dependent on the nature of the two variables (Bryman and Bell, 2011:228). Multivariate analysis involves the simultaneous analysis of three or more variables at the same time (Bryman and Bell, 2011:228).

In this study, the data collected was captured, organised and analysed using SPSS software programme version 21. Descriptive statistics was used to describe the features of the study (Trochim, 2008:425). Frequency distribution, mean and standard deviation formed part of the statistics and they provided descriptive information on the data (Sekaran and Bougie, 2013:325). During this analysis, the mean, median and mode were calculated and the findings were represented graphically. Cross tabulations were also be performed in order to identify whether any relationships or correlations exist between demand planning operations and capacity constraints. This assisted in comparing the relationship between the variables as stated in Williams (2014:156). A chi-square value obtained at a P value less or equal to 0.05 was considered to denote a significant difference between variables under investigation.

3.11 Ethical considerations

Ethical principles guiding research includes respect for people, beneficence and justice. These principles are enforced during the process of conducting the study to ensure that the participants are respected, protected from harm and there is fairness in terms of how the research study is conducted. The following processes were observed in this study as part of ethical considerations:

Ethical Clearance from the Ethics Review Board: This study was subjected to the critique of the Ethics Review Board if the University of KwaZulu-Natal. The Ethics Review Board approved this study and granted an Ethical Clearance Certificate (Annexure 2)

Gatekeeper Permission: Gatekeeper permission was obtained from Néstle ZAR management, granting the researcher permission to collect data from the participants. This was obtained before approaching the prospective participants

Informed consent: The employees who volunteered to participate in this study had to sign an informed consent (Annexure 3) which was accompanied by a Participant Information Sheet (Annexure 4) that provided detailed information about the study. The researcher started by explaining verbally the purpose of the study and the rights of the participants before requesting the participants to sign informed consents.

On-going respect for participants: The researcher explained to the participants that although it was important for the participants to participate in the study up to the end, they had a right to withdraw anytime without any penalty. The researcher informed the participants that they will have access to the findings of this study on completion of the project as they had a right to be informed of the outcome of the study. The participants were also informed that if this work is published their names will not be divulged.

Social value: The findings from this study may have an indirect input in influencing how capacity planning in under resourced constrained organisations is managed in future. Participants and the organisations may benefit indirectly.

Risk-benefit ratio: This study was viewed as a low risk study as there was no potential risk that was identified. There was no cost that was going to be incurred by the participants and there was no way that their names could be associated with the collected data because the informed consent was completed separate and the questionnaire was completed later. There was no way of connecting the collected data to the names of the participants on the informed consents. The potential benefits of this study outweighed the risks to the participants.

3.12 Data management

All data (questionnaires) were strictly managed by the researcher to ensure that the names of the participants remain confidential. The completed questionnaires were assigned numbers and

assigned a special code depending on the category of the participant. The researcher saved captured data on the computer which had a special access code which was known to the researcher. Hard copies of completed questionnaires and signed informed consent forms were kept under lock and key in a special cupboard and the key was kept by the researcher to ensure that no one has access to the questionnaires. The collected data will be disposed to the university policy. The completed questionnaires will be scanned and saved electronically on completion of the study as there is limited space to save hard copies. The completed questionnaires will be shredded using a special shredder in the research supervisor's office that is used for confidential documents.

3.13 Dissemination of findings

A written report in a form of a thesis has been produced and will be submitted to the library at the end of the whole process. The thesis will be accompanied by a CD that will be used to load the final thesis into the University Online Research Space. The findings will be shared with Néstle ZAR management as promised at the time of requesting permission to conduct this study. A publication will also be produced and published in a Supply Chain Management Journal to share the findings with a wider audience.

3.14 Conclusion

In this chapter outline of the methodology used to conduct the study has been provided. The chapter was able to cover the research approach, research design, research setting, population,, sampling process and sample, data collection tools, data collection process, validity and reliability of data collection tools, data analysis, ethical considerations, data management and dissemination of information.

CHAPTER FOUR
DATA PRESENTATION

4.1 Introduction

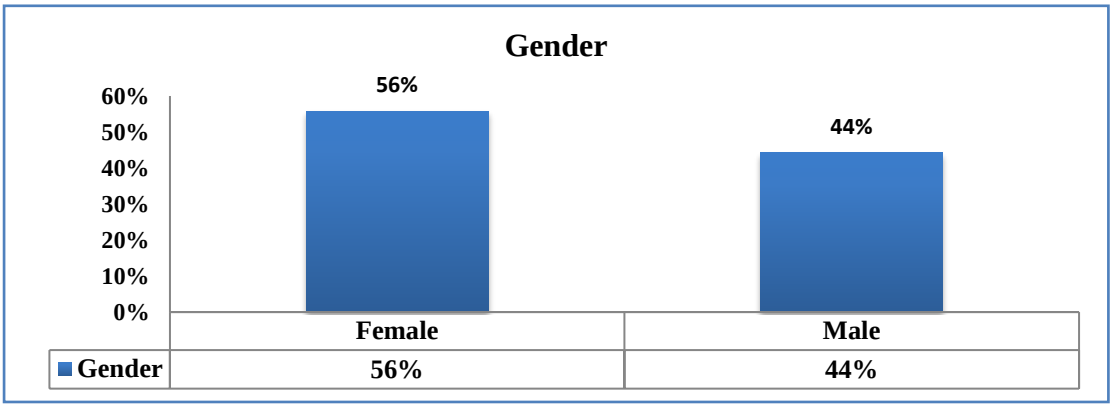
In this chapter, the analysis of data captured from the study findings is presented and discussed. The study has been guided by research questions which are directly related to the findings. To re-iterate, the purpose of this analysis was to explore and understand demand chain planning operations within capacity constraints: Nestlé ZAR. A self-administered questionnaire was used to collect data from the participants. The questionnaire was identified as the most practical tool to obtain useful information from the participants in order to answer the research questions of interest in this study. Data was analysed using frequency distributions and bivariate statistics to establish associations or relationships between variables of interest. The variables will be compared to determine the significant differences thereof, with a *P* value set at 0.05. The findings in this chapter are presented according to the structure of the questionnaire and they will be later discussed in line with the research objectives in this study. In this chapter, a detailed discussion of the results retrieved from the data collected through questionnaires will be presented. Out of 155 participants who were given the questionnaire 86 respondents completed and returned the questionnaires.

4.2 Frequency Distribution for this Study

Frequency distributions are very useful for assessing properties of the distribution scores. It is for this very same reason that this section make use of frequent distribution. The greater part of this section, however, looks at the frequency at which scores occur and does not go to an extent of looking at the likelihood of occurrence. This section aims to present information on the socio-demographic characteristics of participants and information relating to some of the information technology systems employed in the organisation. The data is later used to establish possible influence on the research findings, especially associations and relationships between and amongst variables of interest in this study. Socio-demographic characteristics include gender of the participants, their internal and external work experience, and job level, and the information technology related variables include the number of technology systems used by the organisation in the past five years, and the number of strategic business

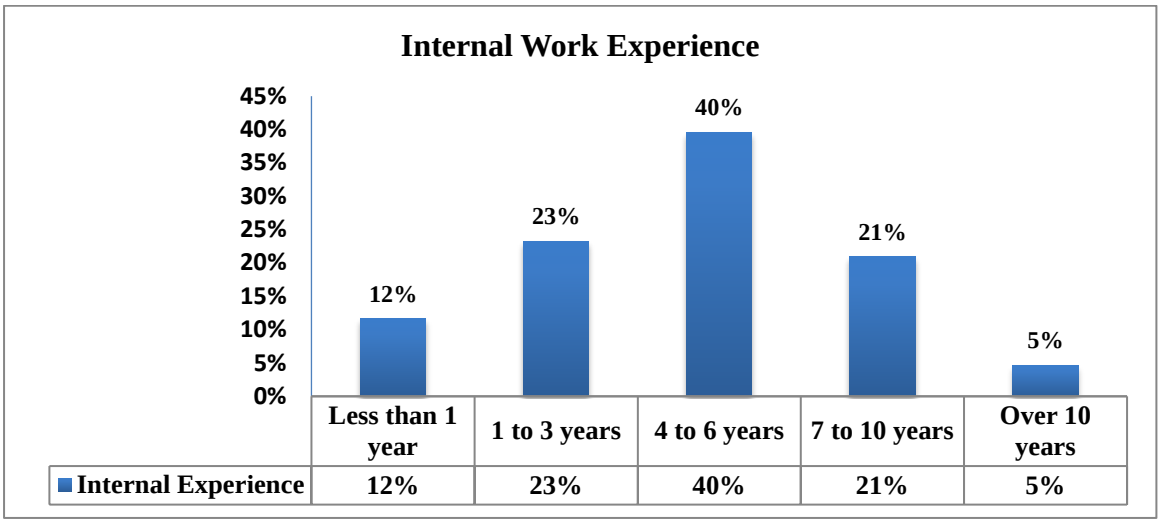
collaborative models that have been used by an organisations for demand planning adaptability in the past five years, according to the participants' experience in the organisation.

Figure 4.1: Gender of the participants



The sample comprised of 48 (56%) females and 38 (44%) males as depicted in figure 4.1. The study did not aim to target mainly females as compared to males, but due to the biographic build of the Supply Chain department at Nestle ZAR, the gender representation comprises of more females than males.

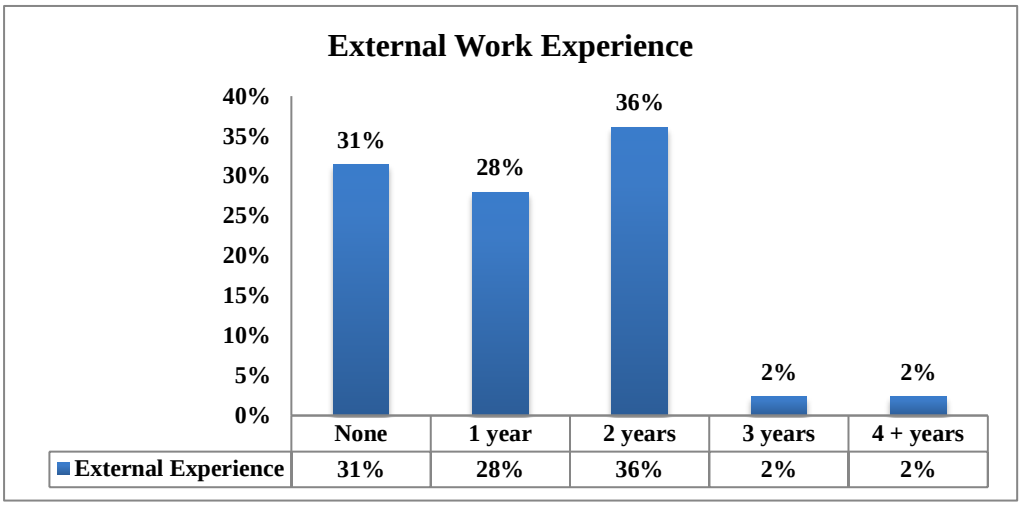
Figure 4.2: Participants Internal Work Experience



This section of the study has focused on the level of experience gained within Nestle ZAR. The results show that forty percent (n-34) of participants have been in Nestle ZAR for more than four years but less than 6 years (See figure 4.2). Twelve percent (n-10) of the participants indicated that they had less than only year internal experience. It is assumed that the perception of the participants and choice of response in the questionnaire is impacted by the level of their

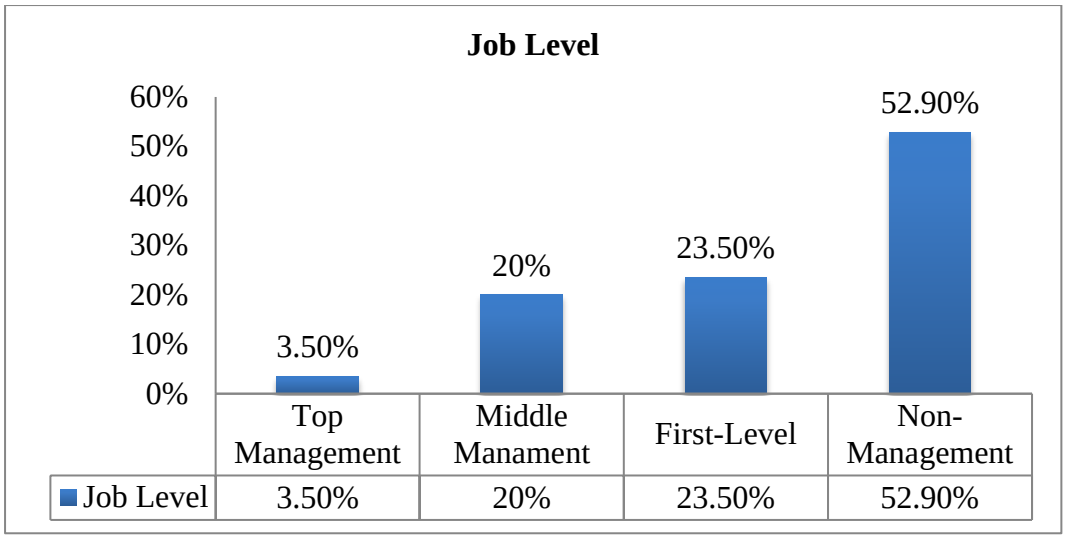
internal work experience. The impact may be as a result of knowledge gained through years of experience, exposure to various job roles in supply chain, experience on changes and development in the company.

Figure 4.3: Participants external work experience



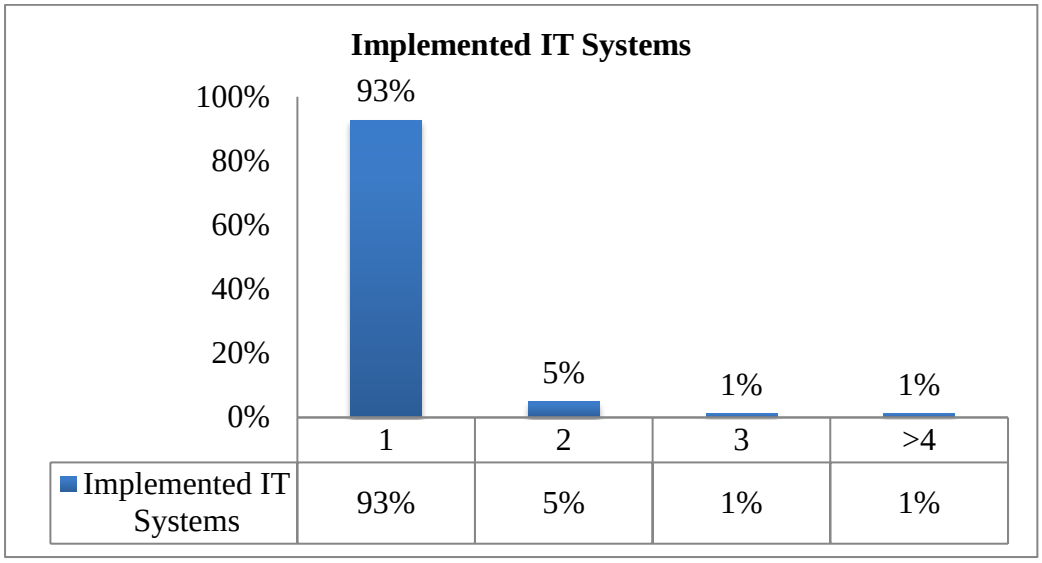
Outside of Nestle ZAR but within the industry. Thirty-six percent (n-31) of respondents have had two years of external experience and those that have no external work experience amounted to thirty-one percent (n-24). This indicate that the responses to the questionnaire will be based on a mixture of views. The level of external experience provides the participant with and extended view when giving responses to the questionnaire.

Figure 4.4: Participants' Job Level



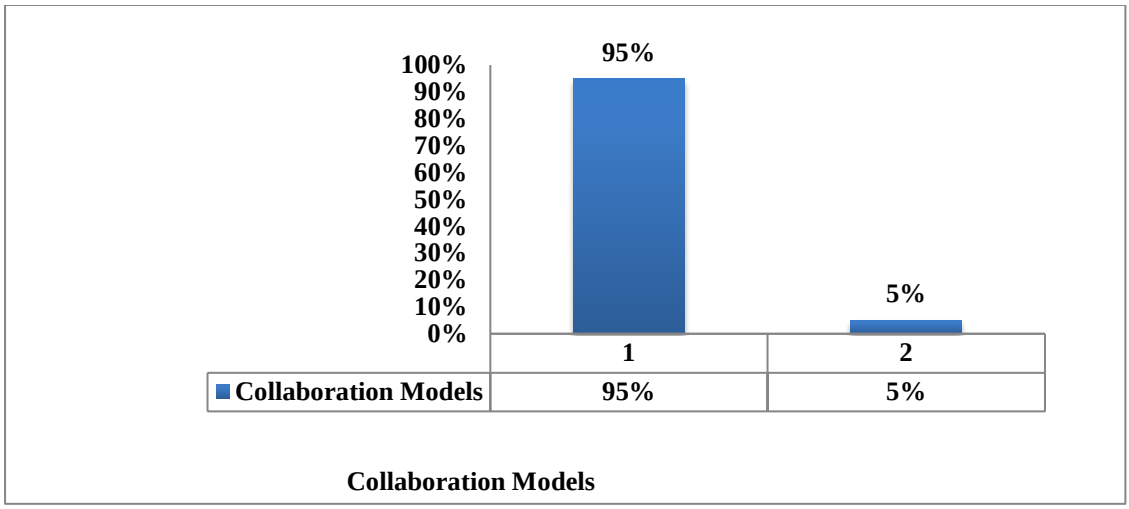
The study findings reflected that a large number (n-45; 52.90%) of respondents were at a non-managerial job level. This is mainly due to number the job roles in each level. The higher the job level the fewer the job roles available, as indicated in the above figure with first level management at 23.50% (n-20); middle management at 20% (n-17) and top management having the lowest respondents of 3.5% (3) as shown in figure 4.4, Job level plays a role in participant's responses as participants in different job levels are exposed to a range of different activities. The environments and responsibility levels may not be the same which provides different perspectives for differing job levels.

Figure 4.5: Information Technology Systems implemented in the past 5 years



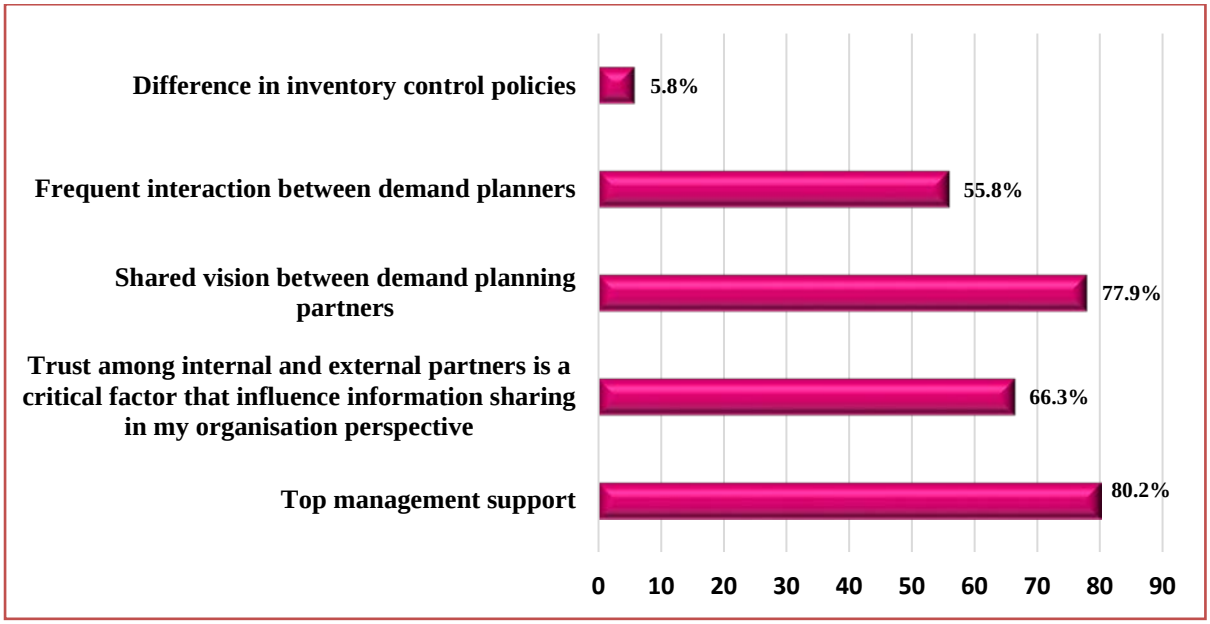
Respondents were asked to indicate the number of information technology systems have been implemented of the past five years, as part of reflecting how the company has evolved with regards to technology infrastructure. The majority (n-76; 93%) of the respondents indicated that only one form of information system has been being implemented in the organisation in the past 5 years, with five percent (n-4) citing two information systems and one percent (n-1) indicating 4 information systems implemented in the organisations, as in Figure 4.5. These responses may be influenced by job role exposure and activities that require information systems.

Figure 4.6: Collaboration Models



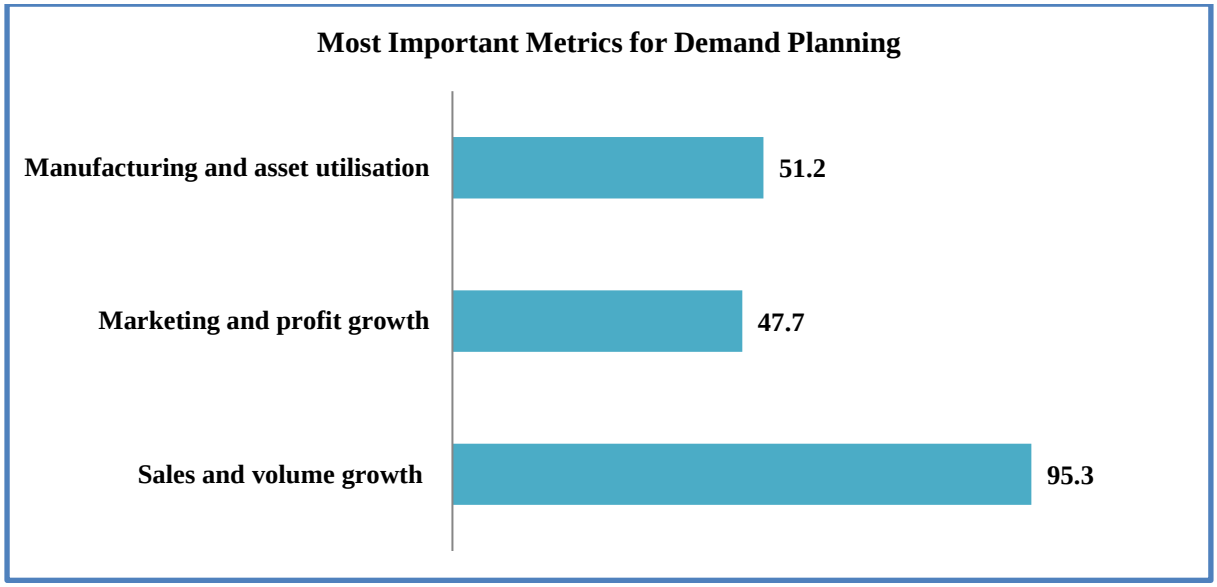
For the variable Collaboration Models the participants were required to indicate the number of strategic business collaboration models that have been used for demand planning adaptability in the past five years. A significant percentage of about 95% (n-74) of the respondent indicated that only one collaboration model was used for demand planning adaptability in the last past five years. The remainder of respondents (5%=n4) indicated that two strategic collaboration models were used in the last five years for demand planning adaptability as shown in Figure 4.6.

Figure 4.7: Critical factors influencing information sharing in the organisation



This item intended to establish the factors respondents perceived as the most critical factors that influence information sharing in the organisations. Eight percent (80%) of respondents perceived top management support as a critical factor in influencing information sharing in the organisations as shown in Figure 4.7. Seventy-seven point nine percent (77.9%) of respondents also cited shared vision between demand planning partners as one of the critical factors. Fifty-five point eight percent (55.8%) of the participants indicated frequent interaction between demand planners as another critical factor. Sixty-six point three percent (66.3%) highlighted trust among internal and external partners as a critical factor that influence information sharing in the organisations perspective. Only options five point eight percent (5.8%) perceived difference in inventory control policies as one of the major factors influencing information sharing, with ninety-four point two percent (94.2%) indicating that they did not believe that this was a critical factor.

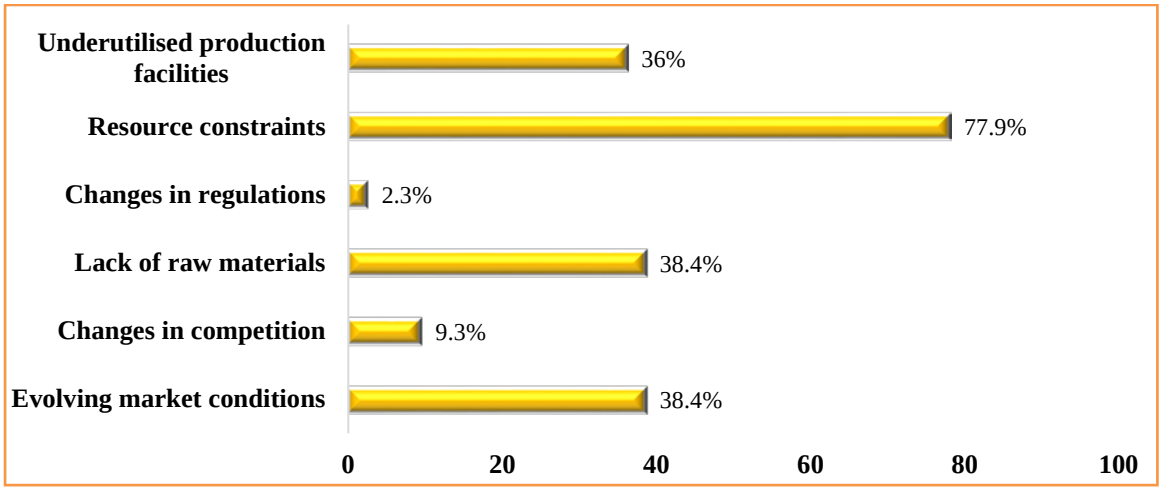
Figure 4.8: Metrics which are most important for demand



This item was intended to identify the metrics that were perceived as most important for collaborative demand planning. The respondents were asked to identify whether they perceived the listed metrics as important for demand planning. Majority of participants at ninety-five point three percent (95.3%) were of the view that sales and volume growth are important factor in collaborative demand planning, as in Figure 4.8. Fifty-one point two percent (51.2%) of the participants identified manufacturing and asset utilisation as important metric for demand planning. Whereas, less than fifty-percent of respondents believe that marketing and profit growth are a key metric to demand planning. This shows that, fifty-two point three percent

(52.3%) of participants did not perceive marketing and profit growth are key metrics of demand planning.

Figure 4.9: General causes of capacity imbalances in the company

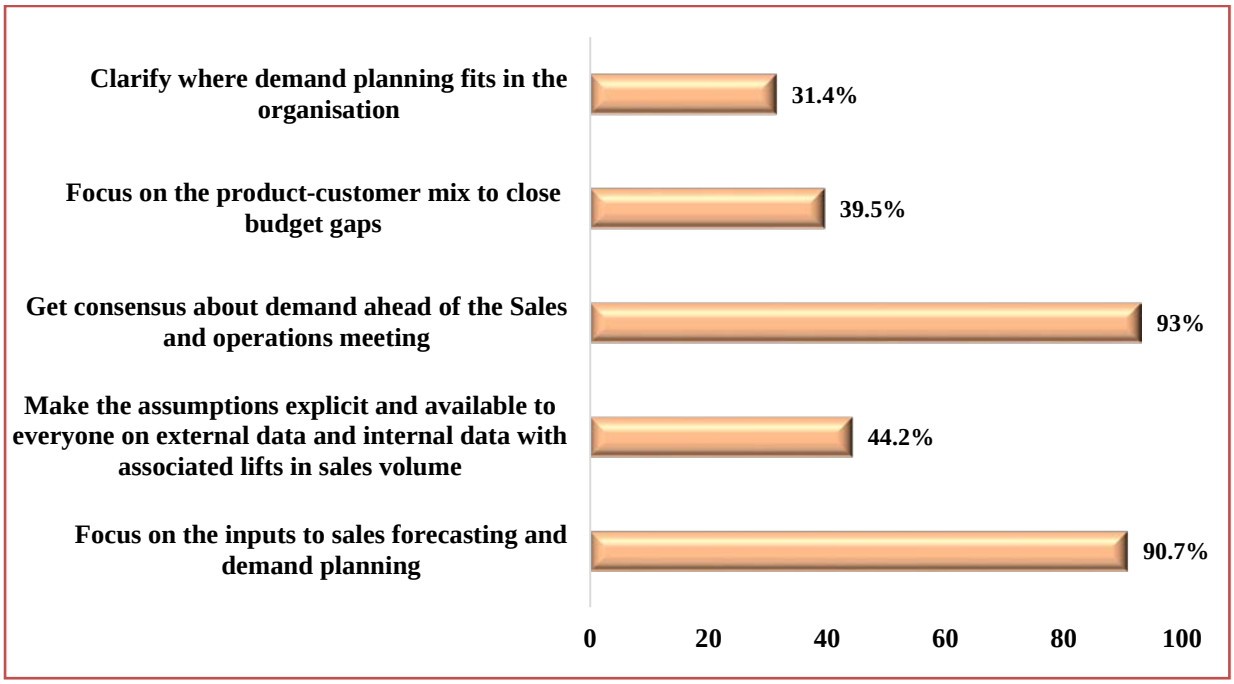


Capacity imbalances commonly arise as a result of unforeseen fluctuations in demand. Figure 4.9 display general causes of capacity imbalances in the company as identified by the participants. Majority of the respondents at seventy-seven point nine percent (77.9%) believe that capacity imbalances in the organisation is mainly caused by resource constraints. The other variables did not have a strong view of being causes of capacity imbalances. Remainder of the variables have less than fifty-percent view of being a general cause of capacity imbalance. Changes in regulations had the least support from respondents as a cause for capacity imbalance at two point three percent (2.3%). Participants also equally viewed lack of raw materials and evolving market conditions at thirty-eight point four percent (38.4%) two of the major causes of capacity imbalances in the company.

In Figure 4.10, respondents were provided with five guiding principles for sales and operations planning process as well as supply chain performance. The respondents were asked to identify whether the principles are relevant for demand planning process. Ninety-three percent (93%) of the participants strongly supported getting consensus about demand ahead of sales and operations meeting as a relevant principle to the demand planning process. Ninety point seven percent (90.7%) of the respondents also believe that focus on the inputs to sales forecasting and demand planning is a relevant guiding principle. Participants did not strong support the principle of clarity where demand planning fits in the organisation as a relevant principle, as only thirty-one point four percent (31.4%) supported this principle. Focus on the product-

customer mix to close budget gaps also received less than fifty percent support as being a relevant principle to the demand planning process, only thirty-nine point five percent (39.5%) believed that this is a relevant principle. Forty-four point two percent (44.2%) of responds are of the view that making assumptions explicit and available to everyone on external data and internal data with associated lifts sales volumes is a relevant principle in the organisation for demand planning process.

Figure 4.10: Principles most relevant for demand planning process in the company



4.3 Inferential Statistics – Cross tabulation

The results from the cross tabulation of gender and job status, as per table 4.1 below, show that out of 85 respondents (60%; n=29) of female respondents were holding non-managerial positions with 43% (n=16) of males in non-managerial positions. The findings show that a notable number of male respondents were occupying middle management positions; they were 29% (n=11) and not many female respondents were holding positions at non managerial (12.5%; n=6). Of the three top management that completed this questionnaire, two were females (4.2%) and one was a male (2.7%). The aim of this study was not based on the gender disposition on job status/level. But it is interesting to note what position respondents hold. In this study it is clear that a large portion of the respondents hold non managerial positions at fifty-two percent (52%) (n=45).

Table 4.1: Gender and Job status/level cross tabulation

Gender and Job status/level cross tabulation					
			Gender		
			Female	Male	Total
Job status/level	Top Management	Freq.	2	1	3
		%	4.2%	2.7%	3.5%
	Middle Management	Freq.	6	11	17
		%	12.5%	29.7%	20.0%
	First-Level	Freq.	11	9	20
		%	22.9%	24.3%	23.5%
	Non-Management	Freq.	29	16	45
		%	60.4%	43.2%	52.9%
Total		Freq.	48	37	85
		%	100.0%	100.0%	100.0%

Table 4.2 above show 52% (n=17) of the respondents who have worked between four and six years in the organisation were in non-managerial positions. With only three percent (n=1) holding top management positions. Majority of respondents that were holding managerial positions were at first level management at 23% (n=20). Those that were in first level managerial positions were 55% (n=11) and were reported to be in the organisation between four to six years. The results shown in figure 4.8 shows that few respondents hold middle or top management positions. This is an indication of the organisational structure. Managerial positions are not based on number of years worked internally, as top managerial positions are equally spread amongst the category one to three years at thirty-three percent (33%) (n=1), four to six years a thirty-three percent (33%) (n=1) and over ten `years internal experience at thirty-three percent (33%) (n=1).

Table 4.2: Number of years working in the Organisation * Job status/level Cross tabulation

			Job status/level				
			Top Management	**Middle Management**	**First-Level**	**Non-Management**	**Total**
Number of years working in the Organisation	**Less than 1 year**	Freq.	0	2	0	8	**10**
		%	0%	11.8%	0%	17.8%	**11.8%**
	1 to 3 years	Freq.	1	0	1	18	**20**
		%	33.3%	0%	5.0%	40.0%	**23.5%**
	4 to 6 years	Freq.	1	4	11	17	**33**
		%	33.3%	23.5%	55.0%	37.8%	**38.8%**
	7 to 10 years	Freq.	0	8	8	2	**18**
		%	0%	47.1%	40.0%	4.4%	**21.2%**
	Over 10 years	Freq.	1	3	0	0	**4**
		%	33.3%	17.6%	0%	0%	**4.7%**
Total		**Freq.**	**3**	**17**	**20**	**45**	**85**
		%	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

4.4. Perceptions on demand chain planning

The respondents had an option of selecting yes or no in response to the items on general perceptions on demand chain planning. The results were skewed to one side with the majority of the respondents perceiving demand chain planning positively (See Table 4.3). All the participants (100%; n=86) responded positively to the item that the advancement of technology have made internal network integration accessible to real time demand information visibility. About 98.8% (85) indicated that the extent of sharing demand planning information improves demand chain performance and 98% (n=84) stated that collaborative planning and replenishment links sales and marketing information to demand chain planning and execution processes. About 97.7 (n=84) stated that collaborative demand planning utilises information shared by different functions in an organisation to achieve a one number forecast amongst the functions. About 96.5% (n=82) of the responded stated that collaborative planning and replenishment in your company is a tool used to achieve lower inventories, logistical costs and create efficiencies and that capacity decisions generally determine capital requirements, which take up a share of a company's fixed costs, and also indicated that the company is able to formulate their demand plans collaboratively to improve the accuracy of their forecasts.

Table: 4.3: General perceptions of demand chain planning

	Yes	
	Freq.	**%**
The process of demand planning determines the capabilities of physical production facilities	69	80.2
The extent of sharing demand planning information improves demand chain performance	85	98.8
The effectiveness of collaborative demand planning and forecasting influences the capability and utilisation of business capacity	80	93.0
The company is able to link customers and suppliers together into closely integrated networks through demand chain management	73	84.9
Demand chain management is a practice that manages collaboration and coordinates planning and forecasting activities	64	74.4
The advancement of technology have made internal network integration accessible to real time demand information visibility	86	100.0
Demand planning is the process of forecasting how a product will sell and meet customer needs	78	90.7
Demand planning is a business process that predetermines future demand for both products and service levels	81	94.2
Demand planning is the business that assists in the aligning of production and distribution capabilities	80	93.0
Demand planning is the business that assists in the aligning of production and distribution capabilities.	65	75.6
Demand planning is the mechanism by which an organisation can foresee potential risks in the supply chain	79	91.9
Demand planning provides a company with an opportunity to redesign its forecasting process	72	83.7
Collaborative demand planning utilises information shared by different functions in an organisation to achieve a one number forecast amongst the functions	84	97.7
The company is able to formulate their demand plans collaboratively to improve the accuracy of their forecasts	82	96.5
Collaborative Plan benefits a business as it aligns key metrics that are important to different functions	75	88.2
Collaborative Plan enables to address business needs and achieve the most realistic plans	79	92.9
Collaborative planning and replenishment in your company is a tool used to achieve lower inventories, logistical costs and create efficiencies	82	96.5
Collaborative planning and replenishment links sales and marketing information to demand chain planning and execution processes	84	98.8
Capacity decisions generally determine capital requirements, which take up a share of a company's fixed costs	82	96.5

About 94.2% (n=81) stated that demand planning is a business process that predetermines future demand for both products and service levels. Ninety-three percent (n=80) stated that demand planning is the business that assists in the aligning of production and distribution capabilities and also stated that the effectiveness of collaborative demand planning and forecasting influences the capability and utilisation of business capacity. About 92.9 % (n=79)

stated that collaborative Plan enables to address business needs and achieve the most realistic plans and that demand planning is the mechanism by which an organisation can foresee potential risks in the supply chain. About 90.7% (78) of the respondents indicated that demand planning is the process of forecasting how a product will sell and meet customer needs.

About 88.2% stated that collaborative planning benefits a business as it aligns key metrics that are important to different functions, 84.9 (n=73) indicated that company is able to link customers and suppliers together into closely integrated networks through demand chain management, 83.7% (n=72) stated that demand planning provides a company with an opportunity to redesign its forecasting process, with 80.2% (69) indicating that the process of demand planning determines the capabilities of physical production facilities. About 75.6% (n=65) stated that demand planning is the business that assists in the aligning of production and distribution capabilities and 74.4% (n=64) indicating that demand chain management is a practice that manages collaboration and coordinates planning and forecasting activities.

4.5. Demand chain and principles

The respondent were requested to respond to the items below based on their experiences in the organisation. They had options which included strongly disagree (SD), Agree (A), Neutral (N), Agree (A) and Strongly Agree (SA); see Table 4.4). The majority (60%; n=51) stated that demand chain planning process is influenced by the integrated information sharing, 57.7% indicated that the organisations jointly participate in updating the demand forecast across the stream sites of demand chain, 63.1% (n=53) stated that the Collaborative planning and replenishment links sales and marketing information to demand chain planning and execution processes, 59.3% (n=51) highlighted that collaborative planning benefits a business as it aligns key metrics that are important to different functions. About 53.5 % (n=46) indicated that collaborative demand planning utilises information shared by different functions in an organisation to achieve a one number forecast amongst the functions, 60% (n=50) stated that collaborative demand forecasting maximizes production capacity capabilities and the majority of the responded were neutral on the items pull-based system as demand-driven strategy improves production and distribution coordination in demand planning processes (60%; n=51), and agility as an operational strategy focuses on inducing velocity and flexibility in demand chain planning (52.9%; n=45).

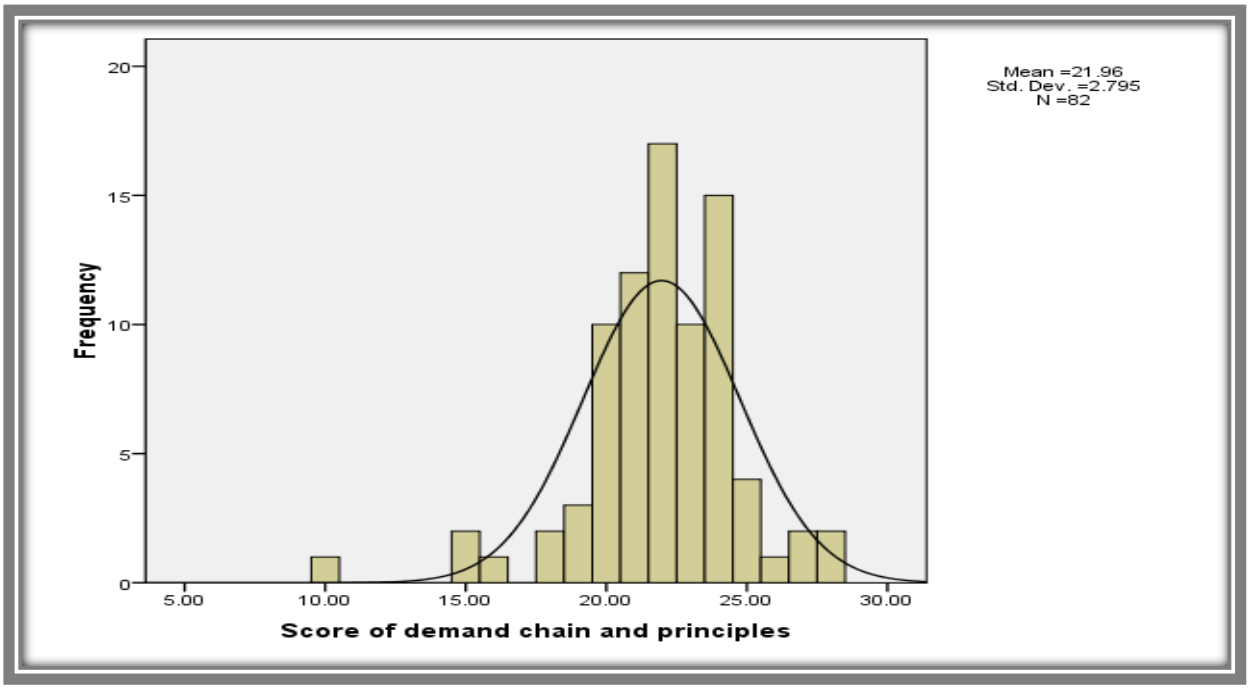
Table 4.4: Demand chain and principles

	SD		D		N		A		SA	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Demand chain planning process is influenced by the integrated information sharing	2	2.4	5	5.9	8	9.4	**51**	**60.0**	19	22.4
The organisations jointly participate in updating the demand forecast across the stream sites of demand chain.	0	0	3	3.5	26	30.6	**49**	**57.6**	7	8.2
Collaborative planning and replenishment links sales and marketing information to demand chain planning and execution processes	1	1.2	2	2.4	12	14.3	**53**	**63.1**	16	19.0
Collaborative plan benefits a business as it aligns key metrics that are important to different functions	1	1.2	2	2.3	21	24.4	**51**	**59.3**	11	12.8
Collaborative demand planning utilises information shared by different functions in an organisation to achieve a one number forecast amongst the functions	1	1.2	3	3.5	14	16.3	**46**	**53.5**	22	25.6
Collaborative demand forecasting maximizes production capacity capabilities	2	2.4	5	5.9	8	9.4	**51**	**60.0**	19	22.4
Pull-based system as demand-driven strategy improves production and distribution coordination in demand planning processes	0	0	14	16.5	**51**	**60.0**	17	20.0	3	3.5
Agility as an operational strategy focuses on inducing velocity and flexibility in demand chain planning	2	2.4	3	3.5	**45**	**52.9**	27	31.8	8	9.4

4.6. Overall score on demand planning principles

An overall score was calculated for the items mentioned above on demand planning and principles. Eight items were considered and the responses ranged from 1=Strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree. The higher score indicated a higher perception towards the demand chain principles, and the lower the score is, the lower is the perceptions towards the demand chain principles. The minimum score was 10 and the maximum score was 28. The mean score was 21.96, and the standard deviation was 2.795. An average of 50% scored 22 which indicated a relatively high positive perception with regards to demand chain principles.

Figure 4.11: Overall score demand chain principles



4.7. Information sharing

Based on their experiences in the organisation, the respondents were requested to respond to the items below and circle and appropriate response. They had options which included strongly disagree (SD), Agree (A), Neutral (N), Agree (A) and Strongly Agree (SA); see Table 4.5). The majority of the participants positively responded to the statement that information sharing achieves demand chain coordination and improves collaborative demand planning. About 53.5% (n=46) strongly agreed and 37.3 % (n=32) agreed to this statement. About 80.2% (69) strongly agreed to the statement that quality information sharing contributes positively to higher demand planning accuracy. About 58.1% (n=50) agreed to the statement that integrated electronic demand chain management systems improve information sharing, with 30.2% (30) having ticked strongly agree to this statement. The large percentage of the responded agreed to the statements that integrated electronic demand chain management systems improve information sharing (52.3%; n=45), adequate IT infrastructure (Structural) was necessary to facilitate information sharing across stakeholders (Planners, Sales and Production) 948.2%; n=41), and quality data inputs required for demand plans are received from relevant stakeholders (38.4; n=33).

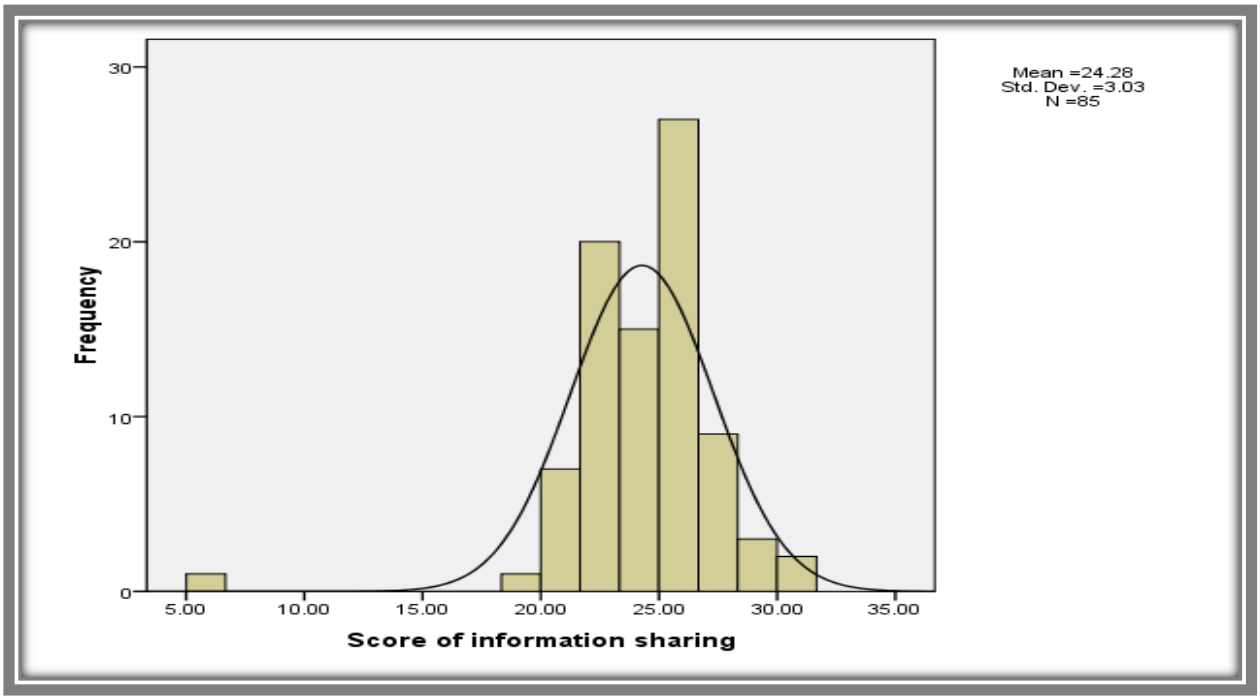
Table 4.5: Information sharing

	SD		**D**		**N**		**A**		**SA**	
	F	%	F	%	F	%	F	%	F	%
Information sharing achieves demand chain coordination and improves collaborative demand planning	1	1.2	0	0	7	8.1	32	37.2	**46**	**53.5**
Quality information sharing contributes positively to higher demand planning accuracy	1	1.2	0	0	1	1.2	15	17.4	**69**	**80.2**
Integrated electronic demand chain management systems improve information sharing	1	1.2	0	0	9	10.5	**50**	**58.1**	26	30.2
Information velocity improves functional information flow on demand planning processes	1	1.2	1	1.2	21	24.4	**45**	**52.3**	18	20.9
Adequate IT infrastructure (Structural) to facilitate information sharing across stakeholders (Planners, Sales and Production)	1	1.2	4	4.7	21	24.7	**41**	**48.2**	18	21.2
Quality data inputs required for demand plans are received from relevant stakeholders	3	3.5	25	29.1	18	20.9	**33**	**38.4**	7	8.1

4.8. Information sharing overall score

An overall score was calculated for the items mentioned above. Six items were considered and the responses ranged from 1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree. The higher score indicated a higher perception towards the information sharing, and the lower the score is, the lower is the perceptions towards the information sharing. The minimum score was 23 and the maximum score was 26. The mean score was 24.28, and the standard deviation was 3.03. An average of 50% scored 24 which indicated a relatively high positive perception with regards to information sharing.

Figure 4.12: Information sharing overall score



4.9. Capacity constraints perceived or experienced in the organisation

The participants responded to the items on capacity constraints which were perceived or experienced in their organisations by choosing one option from a range of options which included strongly disagree (SD), Agree (A), Neutral (N), Agree (A) and Strongly Agree (SA) as in Table 4.6. The highest number of the responded disagreed with the statement that congestion goods in temporary holding areas was experienced in their organisation; 40.5% (n=34) stated strongly agreed to the statement that all goods have appropriately allocated placement areas. Although 35.7% (n=30) were neutral to the statement that staff working hours are scheduled according to demand 34.5 % (n=29) agreed to this statement. Majority of the responded disagreed with the statements that high level of overtime worked by staff was experienced in their organisation (70.2%; n=59), rescheduling frequency at production facilities due to change in demand plans (56%; n=47) and production facilities operate according to demand plan scheduling (47.6%; n=40)

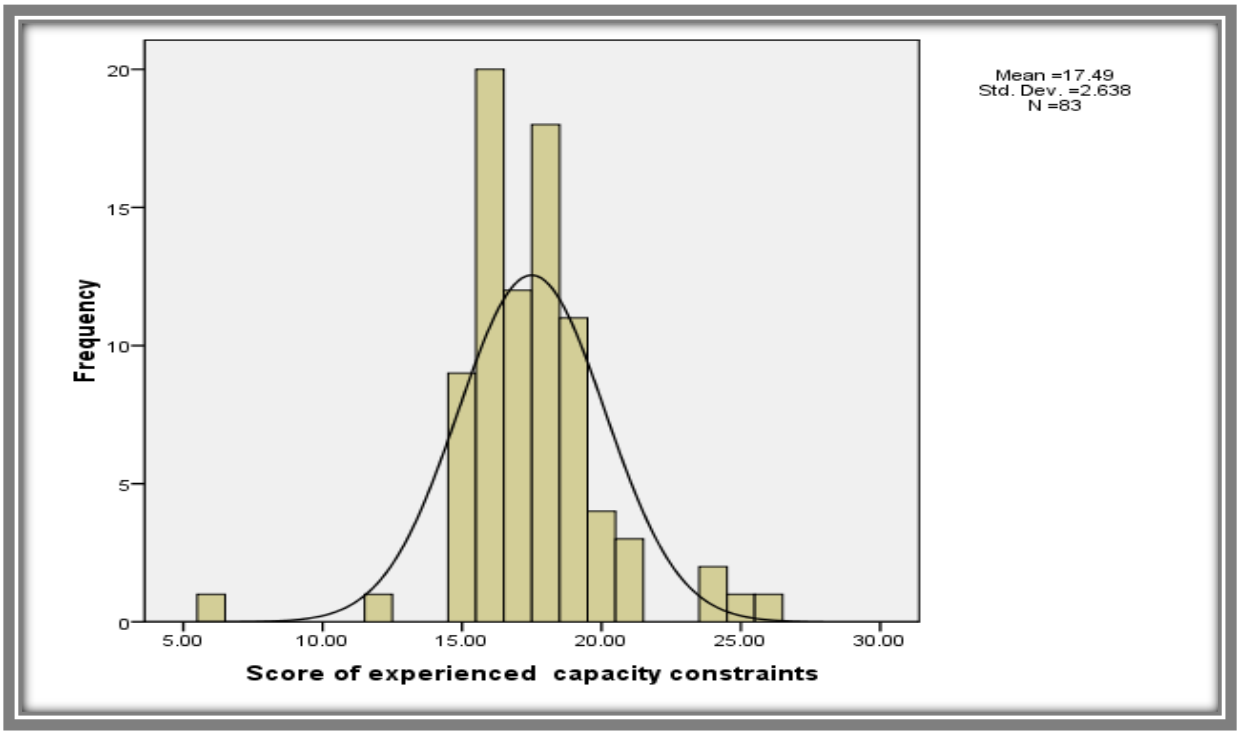
Table 4.6 Capacity constraints perceived or experienced in the organisation

	SD		**D**		**N**		**A**		**SD**	
	F	**%**	**F.**	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Congestion of goods in temporary holding areas	5	6.0	**34**	**40.5**	26	31.0	15	17.9	4	4.8
All goods have appropriately allocated placement areas	1	1.2	6	7.1	15	17.9	28	33.3	**34**	**40.5**
Staff working hours are scheduled according to demand	2	2.4	20	23.8	30	**35.7**	**29**	**34.5**	3	3.6
High level of overtime worked by staff.	1	1.2	**59**	**70.2**	22	26.2	1	1.2	1	1.2
Rescheduling frequency at production facilities due to change in demand plans	1	1.2	**47**	**56.0**	26	31.0	7	8.3	3	3.6
Production facilities operate according to demand plan scheduling	2	2.4	**40**	**47.6**	24	28.6	12	14.3	6	7.1

4.10. Capacity constraints overall score

An overall score was calculated for the items mentioned above. Six items were considered and the responses ranged from 1=strongly disagree, 2=Disagree, 3=Neutral, 4=Agree, 5=Strongly Agree. The higher score indicated a high perception towards the demand chain principles, and the lower the score is, the lower is the perceptions towards the demand chain principles. The minimum score was 6 and the maximum score was 26. The mean score was 17.49, and the standard deviation was 2.638. An average of 50% scored 17, which indicated that moderately the participants experienced capacity constraints.

Figure 4.13: Capacity constraints overall score



4.11. Summary of Descriptive Statistics (Table 4.7)

Descriptive statistics was used to transform and interpret collected data to be presented in this chapter. The purpose of using descriptive statistics was to describe the basic feature of the study, describing what is or what the data is stating. This includes a description of the sample characteristics, the variables range, mean and the standard deviation.

Descriptive statistics enabled the researcher to describe and compare variables numerically. This design is used to measure central tendencies and describe behaviours of random variables in terms of peaks through the measures of dispersion (kurtosis). The distribution of the datae is negatively skewed when the mean is less than the mode, this means a large amount of data in the distribution is clustered towards the upper limit. Whereas, the data set (distribution) is positively skewed when the mean is greater than the mode, this shows that the data is clustered towards the lower limit. These two instances provide an asymmetric result of distribution. When the mean is equal to the mode and equal to the median, the distribution is normal and symmetrical. This means that the variables are centred on the mean.

The number of non-missing values in the data output is depicted by the valid n (listwise). N represents the number of valid observations for the variables. The total number of observations

is the sum of variable values (*n* values) and the number of missing values. The mean is a measure of central tendency the shows a general picture of the data. It provides an arithmetic mean across observations. The mean can be sensitive to very large or small values. The standard deviation offers in index of the spread of a distribution or the variability of data as the square root of the variance. It depicts the level of deviation away from the mean. Accuracy of future predictions is most likely when the standard deviation is smaller the higher the standard deviation, the more spread out the observations are. Level of symmetry is measured by skewedness, it shows the direction and degree. A normal distribution is achieved when skewedness is zero (0).

Table 4.7: Summary of Descriptive Statistics

	N	Mean	Std. Deviation	Skewedness	Median	Mode	Kurtosis
Extent of shared demand planning information	86	1.01	0.11	9.27	1.00	1.00	86.00
Business Capacity	86	1.07	0.26	3.44	1.00	1.00	10.05
Integrated Info Sharing	86	1.15	0.36	1.98	1.00	1.00	1.98
Customer Linkages	86	1.26	0.44	1.14	1.00	1.00	-0.72
Collaboration and Coordination Practices	86	1.00	0.00		1.00	1.00	
Advancement of technology	86	1.09	0.29	2.85	1.00	1.00	6.28
Forecasting Processing	86	1.06	0.24	3.84	1.00	1.00	13.08
Business Process	86	1.07	0.26	3.44	1.00	1.00	10.05
Business Aligned Production Distribution	86	1.24	0.43	1.21	1.00	1.00	-0.54
Business Risk Mechanism	86	1.08	0.28	3.12	1.00	1.00	7.90
Business Redesign opportunity	86	1.16	0.37	1.86	1.00	1.00	1.49
Functional Information Sharing	86	1.02	0.15	6.44	1.00	1.00	40.40
Demand Plan Formulation	85	1.04	0.19	5.13	1.00	1.00	24.88
Scorecard Benefits	85	1.12	0.32	2.42	1.00	1.00	3.93
Enabling Scorecard	85	1.07	0.26	3.41	1.00	1.00	9.88
Collaborative Planning and Replenishment	85	1.04	0.19	5.13	1.00	1.00	24.88
Internal Linkages	85	1.08	0.47	5.98	1.00	1.00	35.60
Capacity Decisions	85	1.11	0.49	5.28	1.00	1.00	28.82
Valid N (listwise)	86						

In Table 4.7 descriptive statistics, a summary of information relating to the variable run to perform descriptive statistics is given. This table shows that eight-six (86) participants responded to questions on physical production capacity; extent of shared demand planning

information business capacity; integrated info sharing; customer linkages; collaboration and coordination practices; advancement of technology; forecasting processing; business process; business aligned production distribution; business risk mechanism; business redesign opportunity and functional information sharing. Eighty-five (85) participants responded to those questions on: Demand Plan Formulation; scorecard benefits; enabling scorecard; collaborative planning and replenishment; internal linkages and capacity decisions

The output mean for 'Extent of shared demand planning information' in Table 4.1 is 1.01 which is slightly greater than the mode of 1.0 and the median of 1.0. This shows that on average at least fifty percent (50%) or more of the respondents are of the view that the extent of sharing demand planning information improves demand chain performance. The standard deviation is 0.11, which is closer to zero showing that the distribution of responses were not highly spread out. The skewedness shows the level of symmetry of the distribution. The Kurtosis value focuses on the peakedness of the distribution. For 'Extent of shared demand planning information' kurtosis value is 86. This indicates that the distribution of the responses is peaked and is clustered towards the centre.

More than fifty percent (50%) of respondents believe that the effectiveness of collaborative demand planning and forecasting influences the capability and utilisation of business capacity. This is supported by the fact that the mean for variable 'Business Capacity' has a mean of 1.07 which is greater than the median and the mode. The standard deviation for this variable is 0.26 (closer to zero) shows that responses are spread and not clustered on a central points and also indicates that there was low variability in responses.

Variables on information sharing which include 'Integrated information sharing' and 'Functional information sharing' had mean values that are greater than median and mode. This indicates for both variables on average more than fifty percent of respondents have the view that demand chain planning process is influenced by the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities. As well as supported the view that collaborative demand planning utilises information shared by different functions in an organisation to achieve a one number forecast amongst the functions.

'Integrated information sharing' had a slightly higher dispersion of distribution of 0.36 as compared to the standard deviation 0.15 for the variable 'Functional information sharing'. Even though there is slight variation, the standard deviation values are closer to zero which shows that the data was clustered toward a central point and there was low variability in responses.

The variable ‘Customer Linkages’ resulted with a mean of 1.26 being higher than the median and mode. This indicates that respondents are of the view that the company is able to link customers and suppliers together into closely integrated networks through demand chain management. The respondents were asked to provide general perceptions of the demand chain planning process based on work experience by providing yes or no answers to the variables in Table 4.7.

This resulted in many of the variables having a mean that as greater than the median and mode of 1. This showed that on average more than fifty percent (50%) of the respondents had the aligned perceptions with the variables ‘Business Aligned Production Distribution’ with the highest mean of 1.24. The respondents have the perception that demand chain planning assists with aligning production and distribution capabilities

This variable had a positive standard deviation of 0.43 which indicates that the responses were mainly clustered to the left of the distribution towards the lower values. Kurtosis on the other hand is at -0.54 which indicates that the distribution is flat. For the variable ‘Collaboration and Coordination Practices’ the mean is equal to the mode and equal to the median of 1.0. This shows that the distribution is fairly normal and the cases were centred on the mean. Therefore, fifty percent (50%) of the respondents are of the perception that demand chain management is a practice that manages collaboration and coordinates planning and forecasting activities.

4.12. Relationship between demand chain planning process, and the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities

This study also intended to assess the relative effects in the relationship between demand chain planning process, and the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities. A Spearman's correlation was run to assess the relationship between the socio demographics, the constructs related to demand chain and principles, information sharing, and experienced capacity constraints. Spearman's correlation measures the strength and direction of association between two ranked variables. Pearson product-moment correlation was used initially where there seemed to be some correlations. The Spearman correlation was used based on the observation that the assumptions of the Pearson correlation were somehow markedly violated. Although Pearson chi-square showed some associations, Spearman correlation disputed these assumptions as per the Table 4.8. What was observed however was that although there were no significant association associated,

there was a wide range in the distribution of the responses from the participants. The items where differences were noted are highlighted in Table 4.8 and have asterisk. These included number of years working in the organisations worked, numbers of orgnaisations worked before joining the organisations, job status/level, number of information technologies used and demand chain principles.

Table 4.8: Relationship between demand chain planning process and integrated information sharing and collaborative demand planning in maximising production capabilities

	Gender	Number of years working in the Organisation	Number of Organisations worked before joining this one	Job status/level	Number of **information technology** systems implemented in this organisation in the past 5 years	Number of strategic business collaboration models that have been used by an organisation for demand planning adaptability in the last 5 years	Demand chain and principles	Information sharing	Experienced capacity constraints
Gender	1	0.109	-0.018	-0.185	-0.064	0.108	-0.11	-0.114	0.007
Number of years working in the Organisation	0.109	1	.358**	-.558**	-0.055	0.057	-0.049	-0.079	0.176
Number of Organisations worked before joining this one	-0.02	.358**	1	-.476**	.298**	0.049	-0.181	-0.21	0.171
Job status/level	-0.19	-.558**	-.476**	1	-0.067	-0.068	0.132	0.158	-0.2
Number of information technology systems implemented in this organisation in the past 5 years	-0.06	-0.055	.298**	-0.067	1	-0.05	-0.086	0.107	0.104
Number of strategic business collaboration models that have been used by an organisation for demand planning adaptability in the last 5 years	0.108	0.057	0.049	-0.068	-0.05	1	.229*	-0.052	0.046
Demand chain and principles	-0.11	-0.049	-0.181	0.132	-0.086	.229*	1	0.216	0.118
Information sharing	-0.11	-0.079	-0.21	0.158	0.107	-0.052	0.216	1	0.11
Experienced capacity constraints	0.007	0.176	0.171	-0.2	0.104	0.046	0.118	0.11	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.13. Conclusion

This chapter presented findings from this study following the structure of the questionnaire. The study findings show that the organisation of interest in this study does adhere to capacity planning principles, the majority of the respondents perceived positively the capacity demand planning process. An average of 50% scored 22 which indicated a relatively high positive perception with regards to demand chain principles. The majority of the respondents positively responded to the statements that information sharing achieves demand chain coordination and improves collaborative demand planning. An average of 50% scored 24 which indicated a relatively high positive perception with regards to information sharing. Although the respondents were ticked neutral in some of the items there were few capacity constraints that were perceived or experienced in this organisation. An average of 50% scored 17 which indicated a moderately the participants experienced capacity constraints. These findings will be discussed in the following chapter. They will be discussed according to the research objectives, interpreted in relation to existing literature and a conclusion on this study will be presented in the next chapter including recommendations and limitations of the study and the methodology.

CHAPTER FIVE
DISCUSSION OF RESULTS

5.1 Introduction

The intent behind this study was to understand demand planning operations within capacity constraints. To ensure the study achieves what it was meant to achieve, it then became fit for purpose to generate prerequisite objectives. Objectives were to examine the process of demand planning in determining the capabilities of physical production facilities; to determine the effectiveness of collaborative demand planning and forecasting in managing the capability and utilisation of business capacity; and to determine the extent to which sharing demand planning information improves demand chain performance. The researcher used a quantitative approach to conduct the study. In this chapter the aim is to provide and present the results obtained through a questionnaire which was the instrument of choice. These results will be discussed in terms of the theory and observations made by the study. The findings will also be discussed in relation the research objectives and framework that was used as well as the literature and previous studies on the relevant variables.

5.2 Discussion relating to research objectives

5.2.1 Objective one: To examine the process of demand planning in determining the capabilities of physical production facilities

5.2.1.1 Capacity imbalances under unforeseen fluctuations in demand

This study observed how demand planning impacts capabilities of physical production facilities (capacity). Participants were asked to identify those factors that's mostly impact on capacity. Many on the participants (77.9%) were of the perception that resource constraints impacts the process of demand planning process in determining physical production capabilities thus causing capacity imbalances. Organisations are moving towards working with reduced tied up capital (inventory), consequently inaccurate demand plans that leads to fluctuations are now being absorb by production capacity (Linné and Ekhall, 2013:5). Capacity decisions commonly define capital requirements, which take up a share of a company's fixed costs. These decisions also determine whether customer demand will be met or if facilities will remain idle (Heizer and Render, 2011:315). The result of capacity imbalances thus has major cost implications and can limit the ability for the organisation to meet customer requirements

Linné and Ekhall (2013:5) are of the view that imbalances in capacity is highly influenced by the fluctuations in demand and unstable planning process. Various external factors contribute to these fluctuations including constraint on resources, reduction of supply base for raw materials, changes in competition and changes in regulations (Johnson and Mattson, 2009: 62). This is evident through the participants responses, many of the respondents are of the view that resource constraints (at 77%) is a high impactor of uncertainty and capacity imbalances. Participants did not feel strongly on variables of changes in regulations and changes in competition. This indicates that resource constraints plays a vital role in the role of demand planning when determining physical production capabilities as it results in capacity imbalances.

5.2.1.2 Demand planning process determines and assists in aligning physical production capabilities

The study learnt that many view the demand planning process as a determinant of physical production facilities. It also indicated that participants feel that it assists in aligning these physical production capabilities. Eight point two percent (80.2%) of the respondents were in favour of the view that demand planning determines physical production facilities and nighty three percent (93%) were of the view that it assist in aligning physical production facilities. The holistic demand planning framework derived from the Hierarchical Demand Planning Approach (HDPA), first presented by Hax and Meal (1975) suggests that through the consideration of various factors such as in the demand planning process relevant stakeholders, taking into account the external context as well as various objectives, such as sales, manufacturing plans and capacity capabilities can help align physical production facilities in an organisations (Nielsen and Steger-Jensen, 2006: 6).

Through research done by Triple Point Technologies (2012), it was identified that through a demand planning process that results in accurate demand plans, manufacturers will only be reliant on the ability to satisfy demand on inefficient building of stock. Vlckova and Patak (2011) further emphasise that the implementation of demand plans exploits the forecasting planning horizon and improves decision made on size of production, inventory levels and the utilisation of resources and capacity. This leads to the maximisation of profits in the organisation and along the supply chain.

5.2.1.3 Capacity constrains

The variable of capacity constraints speaks to how the demand planning process has impacted the physical production capabilities. In this study, variables relating to capacity constrains had a mean score was 17.49, and the standard deviation was 2.638. An average of fifty percent (50%) scored 17 which indicated that moderately the participants experienced capacity constraints. In particular, participants did not believe that rescheduling occurred frequency at production facilities due to change in demand plans. Although, only fifty percent (50%) of the participants agreed that production facilities operate according to demand plan scheduling. This indicted that the capacity constraints still exists in the presence of demand planning but it does reduce the existence of constraints in capacity.

Firms can continue to expect fluctuations in demand and this cannot be totally levelled (Buhl and Deuse, 2009:26). This means that continuous adaptation of volume in production and mix is essential to meet requirements for the market (Morawetz, 2012:20). Variations in demand and inventory levels are two factors that will define the level of physical production capacity required (Danese and Kalchschmidt, 2011:204). The ability for a firm to priorities these two factors results in improved planning efficiency (Linne and Ekhall, 2013:19). Therefore, it is vital for an organisation to fully understand market requirements and demand (and customer behaviour) in the process of planning capacity. Business units are involved in the panning process of capacity, thus it is important that people are able to have trust amongst each other to collaborate and create customer value (Tyler, 2003). Internally, businesses can mitigate this by increasing or decreasing make-to-stock, in order to absorb fluctuations (Christopher, 2005:17).

However, organisations now aim to reduce tied up capital (inventory), consequently the fluctuations are now being absorbed by production capacity (Linné and Ekhall, 2013:5). This shift can result in tightened pressure on production capacity and possibly extend the lead times on make-to-order products (Christopher, 2005:19).

5.2.2 **Objective two:** To what extent does sharing demand planning information improves demand chain performance?

5.2.2.1 Factors influence information sharing

Many of the respondents had strong views on two factors that influence information sharing in the organisation. Seventy-seven point nine percent (77.9%) of the participants were of the view that shared vision among demand planning partners is a factor influenced by the level of information sharing. Further, eighty point two percent (80.2%) of respondents believe that support from top management is a crucial influencing factor to sharing information. Trust amongst internal and external partners as well as frequent interactions between demands planners were strongly supported as influencing factors. This indicates that to facilitate information sharing in the organisations top managements should provide sufficient support and a shared vision should exist amongst demand planning partners.

Variables of aligned vision amongst planning partners, communication, trust, reciprocity and power amongst members and support from all levels of management need to be considered as influences in the quality of the information shared amongst supply chain partners (Wu *et al.,* 2014:123). The results from the study shows that variables of trust, support, communication amongst planning partners had strong support as being important factors that influence the level and quality of information sharing in the organisation. Lotfi *et al* (2013:298) also support the view that communication amongst partners and efficient coordination amongst business units is import to achieve valuable information sharing. In contrast Shou *et al* (2013: 2137) states that in markets that are characterised with abundant opportunity, focus is less on the influencing factors and information sharing is highly motivated by opportunities of achieving market growth.

5.2.2.2 Information sharing in the demand planning process

Under general perceptions of demand planning process, a number of variables were taken into consideration that relate to information sharing. Wu *et al* (2014:123) states that in the demand chain, the advancement of technology has propelled the level of information sharing amongst planning partners. In today's operating environment, to improve the level of competitive advantage, supply chain partners have adopted networking concepts in order to facilitate information sharing (Ho *et al.,* 2002:4418). Promoting quality information sharing in the planning process produces significant performance improvements, this includes faster product

developments, reduced lead times and higher flexibility in supply (Cachon and Fisher, 2000; Clark and Hammond, 1997; Fawcett *et al.*, 2008; Frohlich, 2002; Hong and Rao, 2010; Hult *et al.*, 2004; Radjou, 2003). Research has shown that a firm needs to integrate information systems with key supply chain partners in order to facilitate improved information sharing and data exchange (Hult *et al.*, 2007:1037). Evidently, this was also supported through the results as a hundred percent are of the vies that advancement of technology have made internal network integration accessible to real time demand information visibility

The concept of collaborative demand planning utilising information shared by different functions in an organisation to achieve a one number forecast amongst the functions was also examined in order to understand the extent to which sharing demand planning information improves demand chain performance. Ninety-seven point seven percent (97.7%) of the results supports the notion that a collaborative demand plan that utilises information shared by various functions will ultimately result in an aligned forecast. Knowledge sharing can be used to strengthen the effectiveness of organisations planning process, thus optimising its core competencies (Sun, 2013:299). Outcomes of demand plans are a representation of procedures and information sharing mechanisms used to fully optimise forecast in the demand planning process (Vlckova and Patak, 2011:1000). Ma *et al* (2015:246) identifies that using traditional statistical methodology is no longer suitable as it cannot cope with the growth of market and high access to information. Organisations do not solely rely on statistical forecasts for developing accurate future demand plans (forecast). The developed statistical forecast is used as a starting point and input from other key stakeholders is used as a substantiating factor to reach an aligned forecast that considers all relevant factors

It is crucial under demand planning process to have clear and open information sharing as ninety-eight percent (98%) of the participant supports the notion that the extent of sharing demand planning information improves demand chain performance. Information exchange is the key to managing physical product flow through the supply chain, as well as reducing costs and improving service performance of enterprises (Wu *et al.*, 2014:125).

5.2.2.3 Perceptions on information sharing

Based on level of working experience respondents provided the varying perceptions they had on variables of information sharing. Results based on overall perceptions showed that. An average of 50% scored 24 which indicated a relatively high positive perception with regards to

information sharing. In particular a majority of the participants positively responded to the statement that information sharing achieves demand chain coordination and improves collaborative demand planning. About fifty-three point five percent 53.5% strongly agreed and thirty-seven point three percent 37.3 % agreed to this statement. With customers becoming more aware of their improved choices and demanding faster response times, shorter product cycle times and competitive products/services, business goals may be difficult to achieve if business units and supply chain partners continue to work in silos (Zhu *et al.*, 2010:175). This indicates that the benefits of information sharing and collaboration amongst planning partners can highly improve demand chain performance as organisations can provide what the customer wants.

More than fifty percent of the respondents who participated in the study agreed to the view that an integrated electronic demand chain management systems improves information sharing. Fifty two point three percent (52.3%) indicated that an adequate IT infrastructure (Structural) was necessary to facilitate information sharing across stakeholders (Planners, Sales and Production) (48.2%) and quality data inputs required for demand plans are received from relevant stakeholders, thirty eight point (38.4). The advancement of technology has mitigated the costs associated with information sharing and developments such as Enterprise Resource Planning (ERP) and Web technologies have improved the way in which this sharing can occur (Lotfi *et al.*, 2013:299).

Although a supporting view has been provided between the information sharing and its impact on improved demand chain performance. It is key to note that, Partners are more willing to provide information on forecast and sales but are hesitant to share on strategic and sensitive information as supply chain members may choose to use it to their advantage (Fawcett *et al.*, 2009:224). The unwillingness to share such information contravene the benefits that arise from investments made for information sharing and relationships as there is unclear decision making quality (Fawcett, S Wallin, Allred, and Fawcett, A, 2011:39).

5.2.3 **Objective three:** To determine the effectiveness of collaborative demand planning and forecasting in managing the capability and utilisation of business capacity

Sayed *et al* (2009:11662) writes that forecasts and collaborative demand plans are essential to supporting the supply chain process. It is a direct impact to the supply chain and customer

service level as well as other key performance indicators such as out of stock, capacity utilisation, and customer case fill rate and levels of inventory.

The study further explored the extent to which collaborative demand plans benefits a business as it aligns key metrics that are important to different functions. The study showed that having a collaborative demand plan does provide benefits as eight-eight point seven (88.7%) of the responses were for this view. When participants were asked to provide their view on whether the effectiveness of collaborative demand planning and forecasting in managing the capability and utilisation of business capacity, ninety three percent (93%) believed that if there is an effective collaborative demand plan and forecast, an organisation has ability to manage the capability and how business capacity is utilised.

Collaborative Planning, Forecasting and Replenishment (CPFR) provides better planning efficiency and overall performance of the business (Wang *et al.,* 2013:151; Bapna *et al.,* 2010:788). Collaborative planning and forecasting can be used as tool to improve a supply chain by achieving lower inventories, logistical costs and create efficiencies (Toiviainen and Hansen, 2011:3). This is achieved by linking sales and marketing information to supply chain planning and execution processes (Aviv, 2005:2; Schwarz, 2004:328). The collected results of the study indicated that it is common knowledge that collaborative planning and forecasting can be used as a tool to achieve the above mentioned benefits that relate to managing and utilising business capacity efficiently, about ninety-six point five percent were for this view.

5.2.4 **Objective four:** To assess the relative effects in the relationship between demand chain planning process, and the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities

Through the spearman correlation the relationships were tested to address the objective of assessing the relative effects in the relationship between demand chain planning process, and the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities. Through the spearman correlation the relationship between socio demographic, the constructs related to the demand chain principles, information sharing and experienced capacity constraints. Although there were no significant association associated, there was a wide range in the distribution of the responses from the participants.

Choi *et al* (2009) discuss that Collaboration is an essential factor to the success of a supply chain. Collaboration in the demand planning process is established when trust, communication, information sharing and interdependence amongst planning members exits (Wu and Chang, 2010:304, Chong *et al.*, 2009:315). This collaborative relationships creates the opportunity for supply chain partners to share information on forecast data therefore achieving better performance of demand plans.

5.3 Conclusion

This section provided a discussion of the results obtained through questionnaires. It showed how these responses addressed the various objectives that ultimate wanted to address demand planning operations within capacity constraints. This chapter attempted to integrate participant's perceptions and views with literature that already exists.

CHAPTER SIX
CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions and major findings

6.1.1 Conclusion based on literature review

The focus was heavily placed on how the management of supply chains has changed, organisations and supply chain partners have chosen to take a demand chain management approach to running organisations. It was made evident that effective collaborative demand planning is the first step to business planning. Subsequently, production and distribution capabilities can be determined.

It was also noted that quality information sharing is a facilitator of the demand planning process and provides an opportunity to improve demand planning accuracy through the various stakeholders. Though information allows for connectivity in the demand chain but it does not guarantee the protection of information that is shared. This factor, prohibits partners to provide information freely. Capacity constrains will continue to exist in organisations but capacity imbalances can be mitigated by reducing fluctuations in demand. Therefore it is essential for chain partner to actively provide information on factors that may influence demand. Ultimately, the alignment of demand plans to capacity capabilities will allow organisations to meet customer requirements at its optimised capability.

6.1.2 Conclusions based on empirical study

This study addressed a number of objectives to better understand Demand chain planning operations within capacity constraints. Key factors that impacted capacity were identified, it was evident that there was a strong view that resource constraints is a high impactor of uncertainty and capacity imbalances. Underutilised production facilities was also identified as an influencing factor though it only received moderate support. This indicated that an external factor such resource constraints a plays a crucial role in the demand planning process as it determines capacity capabilities.

The outcomes of the study identified demand planning process as a determinant of physical production facilities. It also was evident that it assists in the alignment of capacity capabilities.

The variable of capacity constraints addressed how the demand planning process has impacted the physical production capabilities. It was recognised that production facilities operate according to demand plan scheduling, although no strong positive views were apparent towards this notion. Thus indicted that the capacity constraints will continue to exist in the presence of demand planning but it can assist in reducing the impact of constrained capacity.

Quality of information shared is highly influenced by a shared vision amongst demand planning partners and top management support. Trust amongst internal and external partners as well as frequent interactions between demands planners were also noted as supporting factors to facilitating information sharing. The objective was to understand extent does sharing demand planning information improves demand chain performance. A collaborative demand plan that utilises information shared by various functions will ultimately result in an aligned forecast and improve demand chain performance. Highly positive views were expressed towards the statement that information sharing achieves demand chain coordination and improves collaborative demand planning This suggests that the benefits of information sharing and collaboration amongst planning partners can highly improve demand chain performance as organisations can provide what the customer wants.

It is essential that collaborative demand plans and forecasts are realistic as they manage the capability and utilisation of business capacity. The study indicated that it is common knowledge that collaborative planning and forecasting can be used as a tool to achieve by lower inventories, logistical costs and create efficiencies in the demand chain.

6.2 Contributions of study to knowledge

The study has been conducted to offer insight on Demand chain planning operations within capacity constraints. Results may be valuable for role players as there are limited studies that focused on multiple variables in this field of supply chain management. Although there were no significant associations between the variables of interest in this study, the differences in the responses by the different categories depending on the position in the organisation silently communicates a message of some disjuncture between the views of those at operational level and those at leadership level.

6.3 Limitations and Delimitations of the study

In conducting the study, the researcher was faced with a number of factors, which were outside the researchers' control. These were considered as limiting in achieving the ultimate goal of this particular study.

6.3.1 Limitations

- Availability of the participants. Ensuring availability of the participants became a challenge as other priorities arised for the chosen sample. Scheduled meeting to carry out the study were continuously postponed even though were confirmed. The researcher had to resort to emailing questionnaires.
- Due to the study being conducted in a non-probability nature, conclusions were made from a survey from convenient sampling. Results may not be generalisable to the entire population, but only viewpoints of the group surveyed.
- The response rate although it ranged between adequate and good (54%) generalising the results may not be recommended. The data collection tool was developed by the researcher based on literature. Although it was pilot tested and found valid and reliable but it was used for the first time in this study. Some of the items were found not simple enough for those who do not have educational preparation in Supply Chain Management. For example the Inconsistency in terminology usage in theory and in day to day practice: Participants found a number of the terms used in the field of study as difficult to understand as they are sometimes used differently or sometimes in their day to day practice. The researcher had to engage in a discussion with the participants explaining some of the terms during the information giving session before obtaining informed consent.

6.3.2 Delimitations

- **Use of a single study setting:** The study was conducted in one Province as it was conducted for study purposed and the researcher did not have funding to collect data from all the Provinces in the country. This study could have yielded easily generalisable results.

6.4 Recommendations

Based on the findings in this study as well as the limitations, the recommendations are divided into two; recommendations to the organization and for further research**.**

6.4.1 Recommendations to the Organisation

- Top management should provide full support to information sharing initiatives to facilitate the demand planning process
- Build a consensus demand plan amongst key stake holders
- Improved quality of information shared is required from external stakeholders for input in demand plans
- Plan capacity through time horizons (short, medium and long term) to allow better capacity flexibility in medium and long term horizon.

6.4.2 Recommendations related to further Research

A research study that will include all the Provinces where Nestle ZAR is operating. Enough time and funding should be dedicated to this study to ensure that the issues of limited sample size and low response rate is addressed. The tool used for data collection in this study will have to be revisited and subjected to the scrutiny of the practitioners in Supply Chain Management, those in operational level and in academic institutions to ensure that the terminology used will be understood in an almost similar manner. This will enhance the content and construct validity of the data collection instrument. To enhance participation and improve response rates, the researcher may have to conduct this research in collaboration with the organisation as part of the organisations strategy to generate evidence that will be used to justify some decisions made within the organisation.

6.5 Summary

The primary objectives of this study was to examine the process of demand planning in determining the capabilities of physical production facilities; to establish the extent of sharing demand planning information in improving demand chain performance; to determine the effectiveness of collaborative demand planning and forecasting in managing the capability and utilisation of business capacity; and to assess the relative effects in the relationship between demand chain planning process, and the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities. There is no one single approach to improving demand chain performance, but it was evident that allowing collaborative demand plans by using quality information shared can reduce impact of capacity constraints and improve planning performance.

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Appendix A: Questionnaire

Section One

Demographic Data

1. State the position in the Department: _____

2. Your Gender:

Female		Male	

3. Indicate the number of years working in this organisation:

Less than 1	1- 3	4 - 6	7 – 10	Over 10

4. Indicate the number of other organisations worked for before joining this organisation:

None	One	Two	Three	Four or more

5. What is your job status/level?

Top management	Middle management	First-level	Non-Managerial

6. How many information technology systems have been implemented in the organisation for last 5 years?

One	Two	Three	Four or more	Namely:

7. How many strategic business collaboration models have been used by an organisation for demand planning adaptability in the last 5 years?

One	Two	Three	Four or more	Namely:

8. Which of the following **three critical factors** influence information sharing in your organisation perspective?

Top management support	
Trust among internal and external partners	
Shared vision between demand planning partners	
Frequent interaction between demand planners	
Difference in inventory control policies	

9. Collaborative Plan benefits a business as it aligns key metrics that are important to different functions. Which **TWO** of the following metrics are **MOST** important for demand planning process?

Sales and volume growth	
Marketing and profit growth	
Manufacturing and asset utilization	

10. Capacity imbalances commonly arise as a result of unforeseen fluctuations in demand. Which **TWO** of the following generally cause capacity imbalances in the company?

Evolving market conditions	
Changes in competition	
Lack of raw materials	
Changes in regulations	

Resource constraints	
Underutilised production facilities	

11. Statement extracted from one of the article: "For companies that want a clearer view of demand to improve their Sales & Operations Planning process and supply chain performance, here are five guiding principles". Which **THREE** of the following principles are MOST relevant for demand planning process in your company?

Focus on the inputs to sales forecasting and demand planning	
Make the assumptions explicit and available to everyone on external data and internal data with associated lifts in sales volume.	
Get consensus about demand ahead of the Sales and operations meeting	
Focus on the product-customer mix to close budget gaps	
Clarify where demand planning fits in the organization	

Section Two

This section aims to obtain information on dichotomous questions *(Yes or No)* with regard to general perceptions. Based on your work experience please encircle or tick on the appropriate box (es) below.

	General perceptions Demand Chain Planning Process		
12	The process of demand planning determines the capabilities of physical production facilities.	**Yes**	**No**
13	The extent of sharing demand planning information improves demand chain performance.	**Yes**	**No**
14	The effectiveness of collaborative demand planning and forecasting influences the capability and utilisation of business capacity.	**Yes**	**No**
15	Demand chain planning process is influenced by the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities	**Yes**	**No**
16	The company is able to link customers and suppliers together into closely integrated networks through demand chain management.	**Yes**	**No**
17	Demand chain management is a practice that manages collaboration and coordinates planning and forecasting activities	**Yes**	**No**
18	The advancement of technology have made internal network integration accessible to real time demand information visibility	**Yes**	**No**
19	Demand planning is the process of forecasting how a product will sell and meet customer needs	**Yes**	**No**
20	Demand planning is a business process that predetermines future demand for both products and service levels	**Yes**	**No**
21	Demand planning is the business that assists in the aligning of production and distribution capabilities.	**Yes**	**No**
22	Demand planning is the mechanism by which an organisation can foresee potential risks in the supply chain	**Yes**	**No**
23	Demand planning provides a company with an opportunity to redesign its forecasting process	**Yes**	**No**
24	Collaborative demand planning utilises information shared by different functions in an organisation to achieve a one number forecast amongst the functions	**Yes**	**No**
25	The company is able to formulate their demand plans collaboratively to improve the accuracy of their forecasts	**Yes**	**No**
26	Collaborative Plan benefits a business as it aligns key metrics that are important to different functions	**Yes**	**No**
27	Collaborative Plan enables to address business needs and achieve the most realistic plans	**Yes**	**No**
28	Collaborative planning & replenishment in your company is a tool used to achieve lower inventories, logistical costs and create efficiencies	**Yes**	**No**
29	Collaborative planning & replenishment links sales and marketing information to demand chain planning and execution processes	**Yes**	**No**
30	Capacity decisions generally determine capital requirements, which take up a share of a company's fixed costs.	**Yes**	**No**

Section Three

The following questions are related to the operational relationship between trading supply chain partners. Based on your experience and perception, please encircle or tick on the appropriate number *("1" as strongly disagree, "3" as neutral or neither agree nor disagree, "5" as strongly agree).*

Demand Chain and Principles						
31	Demand chain planning process is influenced by the integrated information sharing and collaborative demand forecasting in maximising production capacity capabilities	**5**	**4**	**3**	**2**	**1**
32	The organisations jointly participate in updating the demand forecast across the stream sites of demand chain.	**5**	**4**	**3**	**2**	**1**
33	Collaborative planning & replenishment links sales and marketing information to demand chain planning and execution processes	**5**	**4**	**3**	**2**	**1**
34	Collaborative plan benefits a business as it aligns key metrics that are important to different functions	**5**	**4**	**3**	**2**	**1**
35	Collaborative demand planning utilises information shared by different functions in an organisation to achieve a one number forecast amongst the functions	**5**	**4**	**3**	**2**	**1**
36	Pull-based system as demand-driven strategy improves production and distribution coordination in demand planning processes	**5**	**4**	**3**	**2**	**1**
37	Agility as an operational strategy focuses on inducing velocity and flexibility in demand chain planning	**5**	**4**	**3**	**2**	**1**
Information Sharing						
38	Information sharing achieves demand chain coordination and improves collaborative demand planning	**5**	**4**	**3**	**2**	**1**
39	Quality information sharing contributes positively to higher demand planning accuracy	**5**	**4**	**3**	**2**	**1**
40	Integrated electronic demand chain management systems improve information sharing	**5**	**4**	**3**	**2**	**1**
41	Information velocity improves functional information flow on demand planning processes	**5**	**4**	**3**	**2**	**1**
42	Adequate IT infrastructure (Structural) to facilitate information sharing across stakeholders (Planners, Sales & Production)	**5**	**4**	**3**	**2**	**1**
43	Quality data inputs required for demand plans are received from relevant stakeholders	**5**	**4**	**3**	**2**	**1**

Section Four

The following questions relate to Capacity constraints experienced or perceived in your company. Based on your experience and perception, please circle or tick on the appropriate number *("1" as strongly disagree, "3" as neutral or neither agree nor disagree, "5" as strongly agree).*

Capacity constraints						
44	Congestion of goods in temporary holding areas	**5**	**4**	**3**	**2**	**1**
45	All goods have appropriately allocated placement areas	**5**	**4**	**3**	**2**	**1**
46	Staff working hours are scheduled according to demand	**5**	**4**	**3**	**2**	**1**
47	High level of overtime worked by staff.	**5**	**4**	**3**	**2**	**1**
48	Rescheduling frequency at production facilities due to change in demand plans	**5**	**4**	**3**	**2**	**1**
49	Production facilities operate according to demand plan scheduling	**5**	**4**	**3**	**2**	**1**

Thank you for participating in this study!!!

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

22 December 2015

Ms Nontobeko N Mtshali 210515429
School of Management, IT & Governance
Westville Campus

Dear Ms Mtshali

Protocol reference number: HSS/1803/015M
Project title: Demand chain planning operations within Capacity Constraints: Nestlé ZAR

Expedited Approval

In response to your application dated 08 December 2015, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol have been granted **FULL APPROVAL.**

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, Please quote the above reference number. lease 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 a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully

.....
Dr Shenuka Singh (Chair)

/px

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

Humanities & Social Sciences Research Ethics Committee
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Appendix C: Certificate from Editor

Editing Declaration

P O Box 531
Hillcrest
3650
KwaZulu-Natal

TO WHOM IT MAY CONCERN

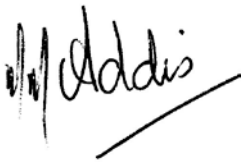
Title of Proposal: Demand chain planning operations within capacity constraints: Nestlé ZAR

Author: Nontobeko Mtshali

This is to certify that I have edited the above proposal from an English language perspective and have made recommendations to the author regarding spelling, grammar, punctuation, structure and general presentation. This did not include cross-checking the references.

A marked-up version of the proposal has been sent to the author and is available as proof of editing.

Yours faithfully



Margaret Addis

12 Kite Place

Woodhaven

Durban

4004

02-02-2016

Editing Declaration

To whom it may concern

Dissertation Title: Demand Chain Operations Within Capacity Constraints: Nestle' Zar

Author: Nontobeko Mtshali

This is to certify that I have edited the above proposal and have made recommendations to the author in respect of grammar, punctuation, spelling, syntax, tense and language

I hold a Bachelor of Arts, English, Drama and Performance Studies, Philosophy; Bachelor of Arts Honours, English, Drama and Performance Studies and a Postgraduate Certificate in Education, English, Drama, Arts and Culture. I do proof reading and professional editing part time.

Yours Faithfully

S Hlengwa

Appendix D: Ethical clearance