

Managing Demand Variability Through Information Sharing:

A Case Study of Imperial Cold Logistics

A research report submitted by

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DECLARATION

I, Amanda Subiah, hereby declare that the thesis titled “Managing Demand Variability Through Information Sharing: A Case Study of Imperial Cold Logistics”, submitted to the University of the Witwatersrand under the Faculty of Commerce, Law and Management is the record of the original research done by me under the supervision and guidance of Andres Merino, Associate Professor and Katinka Vermeulen, Senior Lecturer, School of Accountancy, University of the Witwatersrand. I further declare that no part of the thesis has been submitted elsewhere for the award of any degree, diploma or any other title or recognition.

ABSTRACT

Supply Chain Management (SCM) aims to improve coordination among the various members of a supply chain (manufacturers, distributors and retailers) to increase transparency and reduce the impact of demand variability. The supply chain is currently struggling with the classic symptoms of a mismatch between supply and demand, low sales forecast accuracy, high and aging inventory, as well as low customer service. Because of fluctuating demand and complex interactions among various organizations in the supply chain, the management of the supply chain becomes increasingly challenging. Variability is one of the costliest problems in supply chains, particularly when it amplifies as it flows up the chain. This phenomenon is known as the Bullwhip Effect (BWE) and has drawn much attention in the study of SCM. Anything that is done to stabilise the flow of demand across a supply chain will improve the performance and will result in substantial advantage over chains that must cope with higher levels of variability. The focus of this research was the management of demand variability through information sharing, with a specific focus on Imperial Cold Logistics. As this was an exploratory case study a variety of sources were used to gather information. As part of the study the impact of the BWE across a three-stage supply chain was quantified consisting of a single manufacturer, a single distributor and a single retailer. The results of the study demonstrate the improvement that information sharing has on service levels resulting in improved financial results to all members in the study. The benefits have been quantified for the parties in the supply chain. The study proposes several information sharing mechanisms that can be applied across supply chains.

Keywords: Bullwhip Effect, demand variability, supply chain management, information sharing

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CHAPTER 1

1.1. Introduction

Interest in Supply Chain Management (SCM) has risen to prominence since the 1980's when firms saw the benefits of collaborative relationships within and beyond their own organization. Traditionally, a supply chain is defined as a set of entities (e.g. organizations or individuals) directly involved in the supply and distribution flows of goods, services and information from a source to a destination (customer) (Mentzer et al., 2001). The focus of this traditional approach was on procurement, production and distribution. More recently the focus has shifted to emphasize the need for integration and optimization of the supply chain functions (Lee and Whang, 2000). This represents a significant change from the traditional arm's-length, even adversarial, relationships that often-exemplified buyer/supplier relationships in the past. Coordination among the various members of a supply chain (manufacturers, distributors and retailers) is a focal point for effective SCM.

Internal capabilities of an organisation traditionally centred and depended on the management of material flows. This led to the development of inventory-driven systems. Industries today however are faced with constant change and fierce competition, meaning that the conventional ways of structuring the supply chain is no longer a viable means of survival. The retail environment, characterised by increased competition and globalisation has created a need for more responsive organisational procedures based on effective supply chain alliances. Christopher (2011) defines SCM as the management of upstream and downstream relationships with supplier and customers in order to deliver superior customer value at less cost to the supply chain as a whole. Lee and Whang (2000) suggest that traditional transaction-based intra-organizational relationships give way to partnerships in which information, processes, decisions and resources are shared among partner companies. Thus customer relationship management is the focus of SCM

in order to achieve a more profitable outcome for all parties in the chain (Christopher, 2011).

Because of fluctuating demand and complex interactions among various organizations in the supply chain, the management of the supply chain becomes increasingly challenging. While much attention has been paid to finding innovative ways to reduce inventory levels and increase stock turns, little attention has been paid to understanding, creating and managing demand more effectively (Gattorna, 1998). A further realisation is that the supply chain is driven by market demand (customers), not suppliers. In the supply chain, order quantities upstream (the direction in a supply chain opposite to the flow of materials, e.g. a manufacturer will always be upstream from a retailer) tend to exhibit greater variations when compared to customer demand, which leads to inefficiencies. This variability is referred to as the 'Bullwhip' or 'Forrester effect' and has drawn much attention in the study of SCM (Christopher and Peck, 2012). The Bullwhip Effect (BWE) represents a market pathology in which information about demand becomes increasingly distorted as it moves upstream in the supply chain (Sun and Ren, 2005, Gao et al., 2017). Such distortions can contribute to lost revenue due to excessive stockholding throughout the value chain, poor demand forecasting and unreliable and volatile service levels, which collectively contribute to lost revenues. Its presence is harmful and deteriorates the performance of the supply chain (Pamulety and Pillai, 2011, Monsreal et al., 2016).

There has been a growing recognition that SCM can achieve the twin goals of cost reduction and service enhancement (Christopher, 2011). The quality of a company's supply chain performance can mean the difference between business prosperity and failure (Gattorna, 1998). Cutting-edge supply chains are double-edged swords. Wielded with skill, they can slice open new markets. Improperly handled, they can lead to deep, self-inflicted wounds (Merwe, 2005). With all the advantages of getting the supply chain right, getting it wrong can be catastrophic (Taylor, 2004). Improperly managed supply

chains can be disastrous for organisations, evidenced by, the following widely reported supply chain failures which have occurred since 1999:

- Kmart, a major discount retailer in the US, went bankrupt (Taylor, 2004)
- Nike lost \$ 100 million in lost sales during the year 2000 (Taylor, 2004)
- Cisco Systems wrote off \$ 2.5 billion in excess inventory, owing to poor management of its myriad of outsourced contractors (Merwe, 2005, Christopher and Peck, 2012)
- Micron Technology wrote down \$ 260 million of memory products inventory, representing 32 percent of revenue (Merwe, 2005)
- In 1999, in the months leading up to the over-hyped Y2K doomsday, Hershey's failed to deliver \$150 million of Hershey's Kisses and Jolly Ranchers to stores in time for Halloween. As a result, profit dropped by 19%, and the share price decreased from \$ 57 to \$ 38. (SupplyChainDigest, 2006)

The reality is that superb supply and demand chain management is the challenge confronting supply chain practitioners, and will be the basis of competitive success or failure for many businesses (Gattorna, 1998). The benefits of reducing the supply-demand mismatch are immense. Fewer incongruities between supply and demand can lead to a significant increase in profits, better customer service and therefore additional sales (Gattorna, 1998).

1.2. Statement of the Problem

Low sales forecast accuracy and high and aging inventory, are typical indicators of a supply chain struggling with a mismatch between supply and demand. By holding on to inventory, organisations protect themselves against the uncertainty of the demand brought about by minimal upstream and downstream transparency of market related information. Such chains are slow to respond to volatile demand burdened further by working capital. Supply chains with numerous buffers between the two ends of the chain

face further challenges because minor changes in demand in the final market place are amplified and distorted as they move back through the chain.

Variability is one of the costliest problems in supply chains, particularly when it amplifies as it flows up the chain. Independent and unsynchronised retailer demand leads to uncertainty in the supply chain resulting in high costs, excessive stockholding throughout the value chain, poor demand forecasting and unreliable and volatile service levels, which collectively contribute to lost revenues. Anything that is done to stabilise the flow of demand across the chain, will improve the performance and will result in substantial advantage over chains that must cope with higher levels of variability.

1.3. Purpose

The purpose of this study was to identify the key drivers of demand variability and to determine whether the misalignment within a supply chain between supply and demand can be reduced through information sharing, and to identify the changes needed to achieve this goal.

1.4. Significance of the study

This study could lead to an improvement in the current misalignment between demand and supply between members in a supply chain. Alignment between demand and supply can lead to lower inventory levels, increased service levels, improved working capital management and high sales forecast accuracy. The findings could be extended to all partners within the supply chain, including retail and wholesale customers and its manufacturers. Decision makers in small, medium and large companies, struggling to align the supply and demand in their supply chains, could apply the findings and recommendations.

1.5. Research questions

The research questions of this study were as follows:

- 1) What are the key drivers of demand variability between a manufacturer, a distributor and retailer in a supply chain in a South African context?
- 2) What changes to the procedures, information sharing and controls can be introduced to reduce demand variability?
- 3) Can the benefits of the changes to procedures, information sharing and controls be quantified for the players in the supply chain?

1.6. Assumptions, limitations and delimitations

The research comprised of a three-stage decentralised supply chain consisting of only one retailer, one manufacturer and one distributor in the retail sector in South Africa. Traditionally supply chains also include the supplier to the manufacturer. In this case the research was limited to a three-stage supply chain only, therefore excluding the supplier. Historical demand information was used for a single financial period i.e. January 2017–December 2017, which considered product seasonality, promotions and non-promotions.

The research was conducted from the distributor's perspective and certain complexities of the supply chain were simplified for the case study. The performance measurements used to evaluate the impact of information sharing on the BWE for the distributor will be inventory carrying costs, inbound and outbound service levels and stock outs (lost sales). The research does not consider the optimised logistics costs or efficiencies brought about by reducing demand variability. The results of the study may not be generalisable to all other supply chain relationships, but the literature review, the historical point of sales data collected together with data from the interviews, should stimulate further research.

1.7. Structure of the dissertation

Chapter one has highlighted, outlined and dealt with the research problem, background to the study and the purpose of the study. Chapter Two is the literature review relating to SCM and presents expert findings on this matter. Chapter Three discusses the research methodologies and design used in the study including strategies, instruments and data collection and analysis methods, while explaining the stages and processes involved in the study. Chapter Four deals with the research findings using a variety of data sources i.e. supply chain simulation, interviews and the responses thereto. Chapter Five includes the interpretation and recommendations arising from the research, as well as the conclusion and prospects for further study.

1.8. Definition of terms

3PL – Third Party Logistics Provider

BWE – Bullwhip Effect (demand information becomes distorted as it moves upstream in the supply chain)

EDI – Electronic Data Interchange (transfer of data from one computer system to another by standardized message formatting, without the need for human intervention)

FMCG – Fast Moving Consumer Goods

FDC – Frozen Distribution Centre

ICL – Imperial Cold Logistics (Pty) Ltd

Inbound service levels - proportion of orders filled by the manufacturer against orders placed by 3PL (usually measured in case quantities)

KPI – Key Performance Indicator

Order fill rate/Outbound service levels - proportion of orders filled by the 3PL against orders received from retailer (usually measured in case quantities)

PnP – Pick n Pay

SCM – Supply Chain Management

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

SCM is concerned with the achievement of certain objectives, namely, improving customer satisfaction and service and increasing competitiveness (Janvier-James, 2012). SCM also aims to lower the costs and resources involved in the creation of products as well as improve efficiency and effectiveness. Reduction in inventory levels and associated costs, increasing profitability and improving coordination is also the focus of SCM (Dai et al., 2016).

2.2. Supply Chain Management

2.2.1. Globalisation

The need for SCM has been accelerated by several trends one of which is market globalisation which has forced organisations to develop supply chains that can quickly respond to customers' needs. Confronted with such competitive pressures organisations are faced with decisions regarding the insourcing or outsourcing of the logistics processes of supply and distribution. Logistics, defined as the process of strategically managing the procurement, movement and storage of raw materials, parts, finished inventory and the related information flow through the organisation and its marketing channels, is increasingly being recognised as a vital part of an organisation's marketing strategy (Bolumole, 2000). By outsourcing the logistics processes to a Distributor/Third Party Logistics Provider (3PL) (sometimes referred to as "logistics outsourcing" or "contract logistics") organisations can reconfigure their operations around core competences to take advantage of their collective position within the supply chain. Prahalad and Hamel, in their 1990 paper, highlight this competence-based approach to seeking competitive advantage in the industrial environment. Application of the core-competence strategy to

SCM, reveals that by contracting out non-core, non-value activities to a specialist organisation, a competitive supply chain can be developed.

2.2.2. Innovation

Another trend that has shaped the drive toward SCM is innovation. Organisations, in response to increased pressure posed by intense competition, must continually look for ways to reduce operating expenses while continuously improving customer services. Innovations like Vendor Managed Inventory (VMI), everyday low pricing, activity based costing and cross docking have led to industry-wide efforts to improve the efficiency of SCM (Lee and Whang, 2000).

VMI is one of the most extensively discussed partnering initiatives for improving multi-firm supply chain efficiency. It is a cooperative strategy between user and vendor ensuring product availability at lowest costs and optimizing products for both parties (Dai et al., 2017). For a VMI strategy to be successful, four key measurements must be realized. 1) Importance is placed on mutual trust and information transparency for both the customer and vendor. 2) The strategy must endeavour to reduce the inventory cost in the whole supply chain, which provides a benefit to both parties. 3) Goal congruence, whereby each party understands their responsibilities. 4) The Continuous Improvement Principles are applied to ensure continuous feedback and waste reduction. This approach is an effective method to solve the problem of members in a supply chain holding on to inventory due to the uncertainty of the demand.

2.2.3. Management Control Systems

As competition in industries intensifies, traditional competitive strategies based on operational efficiency are no longer sufficient to generate sustainable competitive advantage (Armash, 2010). The conventional approach of organising economic activities in boundary-spanning forms has become too restrictive and this in turn this has led to the

development of management control systems across firms (Dekker, 2004). Otley (1994) explains that the activity of management control is mounting and no longer confined within the legal boundaries of the organisation. A good example is with respect to buyer-supplier relationships, resulting in increased monitoring and control between members along the supply chain. While management of individual organisations remain in charge of their business units, there is a growing awareness that they are no longer in control of its overall performance (Akkerman and Dellaert, 2005).

Well-managed supply chains represent a competitive advantage and are a major lever of overall firm performance (Jeschonowski et al., 2009). To gain this advantage organisations enter into strategic alliances. Effective inter-organisational management control systems (MCS) are required to drive the supply chain toward increased collaboration. SCM systems facilitate inter-enterprise cooperation and collaboration with suppliers, customers and business partners (Awad and Nassar, 2010). The realization of such collaborative efforts requires integrated behaviour, sharing of information and appropriate management of business relationships. The desires of interorganizational coordination will determine the scope of intensity as to how Electronic Data Interchange (EDI) is used. It is believed that as organizations increase their interaction, EDI use increases in parallel (Reekers and Smithson, 1995).

To extract the most value from inter-organisational alliances, control mechanisms must exist, be it formal or informal. Contractual obligations and organisational instruments for collaboration are formal controls and can be sub divided into outcome and behaviour control mechanisms. Informal control, is based on mechanisms of self-regulation and essentially relies on informal cultures and systems influencing members (Dekker, 2004). A total supply chain solution must be considered to resolve the problem of variability, meaning supply chain partners must work together to remove variability across the chain. Aligning incentives will be the key to gaining sustained co-operation across the supply

chain. Reality is, organisations no longer operate in isolation, they must engage in collaborative partnering to succeed. Christopher (2011) explains that the lines between suppliers, customers and competitors are sometimes becoming increasingly blurred.

2.2.4. Information Sharing and Technology

A prerequisite for inter-organisational collaboration is information sharing. Li and Lin (2006) found that a good inter-organizational relationship based on trust, commitment and shared vision is necessary to encourage information sharing. It is also needed to overcome the fear of information disclosure and the loss of power over the competitor. In conjunction with the above, providing vision and guidance is essential from senior management to support quality information sharing. By cultivating an organisational culture conducive to information sharing, senior management can overcome the reluctance to share information. However Akkerman and Dellaert (2005) argue that the main hurdle in terms of information sharing is now organizational, not technical: sharing of data requires a willingness to display information transparency to suppliers and customers, and this in turn asks for a considerable amount of inter-organizational trust, which is sorely lacking in most buyer–supplier relationships.

Li and Lin (2006) conclude that by sharing available data with other parties within the supply chain, an organization can hasten the information flow. This can improve the efficiency and effectiveness of the supply chain, and respond more rapidly to customers' changing needs. Coordination and integration in SCM have long been the concerns of the academic community as well as the business world. It is thought that in the long run, an organisation can achieve competitive advantage by information sharing. A large body of literature exists showing the advantages of information sharing in SCM (Lee et al., 2000, Lee and Whang, 2000, Du et al., 2017).

While information sharing is important, the quality of the information shared will determine the impact on the supply chain. For quality, undistorted and up-to-date information to be shared at every node within the supply chain, investments in Information Technology (IT) is a must. IT further enables efficient and secure information sharing. Using IT, organisations can increase the level of information being shared which may open new opportunities for value creation.

Without the investment in IT, a well-coordinated supply chain will be difficult to achieve (Cachon and Fisher, 2000). Wal-Mart's Retail Link program, which provides an on-line summary of point-of-sales data to suppliers such as Johnson and Johnson, and UniLever is the most notable application of demand information sharing (Lee et al., 2000). Central to supply chain integration is the use of IT (Hughes et al., 1999). Through its use, supply chain partners can increase the volume and complexity of information exchange. More importantly, it allows for the real-time information sharing, which increases visibility in the extended supply chain (Vanpoucke et al., 2017). Within the broad group of inter-organizational systems EDI seems the most important application with a far reaching impact on the way business is done (Reekers and Smithson, 1995). The exchange of structured electronic documents between computer systems can possibly affect relationships between organisations along with internal structures. Senior management support and IT enablers are considered critical intra-organisational facilitators for MCS.

2.3. Demand Management

The dynamics of the marketplace has transformed in recent years. Characterised by sophisticated and demanding customers and consumers, markets within a competitive environment are far less predictable and more volatile than before. Reliance on traditional strategies is no longer sufficient to achieve market leadership. Organisations must be reconfigured for learning, flexibility and adaptability. Leading organisations are those that can speed up the rate of innovation, bring new products and services to the market place

faster, and replenish demand in shorter lead times and with greater reliability. In other words, these companies are more responsive (Merwe, 2005).

Optimising the internal operations of an organisation is how most traditional supply chains were designed. For production efficiencies to be maximised, the establishment of supplier and distribution arrangements would be driven by the manufacturer. This would achieve the goal of becoming a low-cost producer, by manufacturing in large batches, shipping in large quantities and buffering the factory, both upstream and downstream with inventory.

Supply chains exist to support the flow of demand, supply, and cash (Taylor, 2004). Given the new nature of competition, the power in the supply chain has shifted from the manufacturer to the customer. To adapt to this shift and respond to customer demand, organisations should convert their supply chains from a push to pull. Even though the term SCM is widely recognised, it could be argued that it should really be termed “demand chain management” to reflect the fact that the chain should be driven by the market, not by the manufacturers. Similarly, Christopher (2011) suggests that the word “chain” should be replaced by “network”, since there will typically be multiple suppliers and, indeed, suppliers to suppliers, as well as multiple customers and customers’ customers to be included in the total system.

Demand volatility causes significant complexity, which must be managed (Gattorna, 1998). To manage the demand, the various components must be considered and understood. A strategic supply chain begins with the customer. How an organisation responds to the needs and expectations of its customers, in a manner that maximises profitability will be the primary determinant of the overall success of the organisation. Gattorna (1998) notes that the sourcing, demand flow, customer service and supply chain integration strategies will ensure that the company develops policies that meet the needs

of the market and integrates with supply chain partners to deliver improved shareholder value.

An organisation's capacity to match demand and supply is a function of its reactive capacity, i.e. its ability to respond to market demand. To remain flexible organisations must believe that change does not have to occur only in response to a crisis. Change should be viewed as an opportunity and not a threat; a chance to do something better, not a personal risk (Gattorna, 1998). Demand flexibility requires supply flexibility (Merwe, 2005). Therefore, manufacturers must develop capabilities to vary the rate of production to meet the current rate of demand. Becoming a responsive organisation is the challenge confronting most organisations. Besides responding with innovative solutions to address customer's challenges, organisations should also provide high levels of flexibility in delivery in response to volatile demand.

2.4. The Bullwhip Effect (BWE)

The earliest recognition of the BWE can be traced back to Forrester (1958). Through system dynamics (now known as the BWE) Forrester was the first researcher to provide an academic description of the BWE and attempt to demonstrate its existence. A model of a production-distribution system, is described in terms of six interacting flow systems, the flows of information, materials, orders, money, manpower, and capital equipment. Based on the development and use of a system dynamics simulation model, Forrester determined that irrational decision making is the main determinant of the BWE. Essentially, Forrester pioneered the simulation approach and established the importance of integrating information flow with material flow (Warburton, 2004). Many existing research issues in SCM including demand amplification, inventory swings, the effect of advertising policies on production variations, de-centralised control, or the impact of the use of information technology on the management process have already been pointed

out, or even scrutinised by Forrester in 1961 (Angerhofer and Angelides, 2000). Rong et al. () as a general claim say that demand uncertainty tends to cause the BWE.

2.4.1. Beer Distribution Game

Following on from Forrester, Sterman (1989) illustrates the dynamics of a supply chain through an inventory management experiment known as the “Beer Distribution Game.” The experiment involved a supply chain connecting four members which are customer, retailer, distributor and factory. Inventory decisions are made independently without consultation with other members of the chain. Only the retailer is aware the actual customer demand and the other members base their decision according to the ordering patterns of their immediate downstream (the direction in which materials flow, e.g. a customer will always be downstream from its suppliers) member, which is the sole source of communication. The time that is required for ordering, processing and delivering the beer is represented by ordering and shipping delays. The main objective of the experiment was minimizing total cost, which is the combination of inventory holding and backlogging costs. Sterman (1989) observed three outcomes from the experiment (1) large fluctuations appear in orders and inventories (2) demand amplification increases as one goes to upstream (3) order rate tends to peak from retailer to factory. Having observed these outcomes Sterman (1989) found that the BWE occurs as a result the irrational behaviour of managers or feedback misperception.

2.4.2. Causes of the Bullwhip Effect

Similar to Forrester (1958) and Sterman (1989), Lee et al. (1997) recognised the causes and managerial implications of the BWE. However, in contrast to Forrester (1958) and Sterman (1989) Lee et al. (1997) developed simple mathematical models of supply chain that capture essential aspects of the institutional structure and optimising behaviours of members. The models demonstrate that the BWE is an outcome of the strategic

interactions among rational members of the supply chain. In contrast to previous research, the main distinction implies that organisations wanting to control the BWE must focus on adjusting the chain's procedures and related information sharing and controls, rather than only the decision makers' behaviour. By analytically modelling the operational causes of the BWE Lee et al. (1997) document its effects on specific product lines for both Procter & Gamble (P&G) and Hewlett Packard (HP).

They identified four causes of the BWE as 1) demand signal processing (demand is non-stationary therefore past demand information is used to update forecasts), 2) order batching (retailers order in large batches, and therefore infrequently), 3) price fluctuation (retailers purchase more than their short term needs to take advantage of temporary price discounts) and 4) rationing gaming (retailers inflate their orders to receive a better allocation. The manufacturer will have to ration product quantities in times of capacity shortages, because demand exceeds supply).

Demand signal processing and order batching are considered to be interconnected since they are driven by each member trying to optimise internal operations of inventory management. Since price fluctuations and the rationing game reflect the member's reaction to market dynamics they are also considered to be interrelated.

The graphs that follow illustrates demand variability in a supply chain for a typical consumer product. Although the variation in sales is slight, there is a pronounced variability in the orders to the wholesaler. Orders to the manufacturer and the manufacturer's supplier show greater variability.

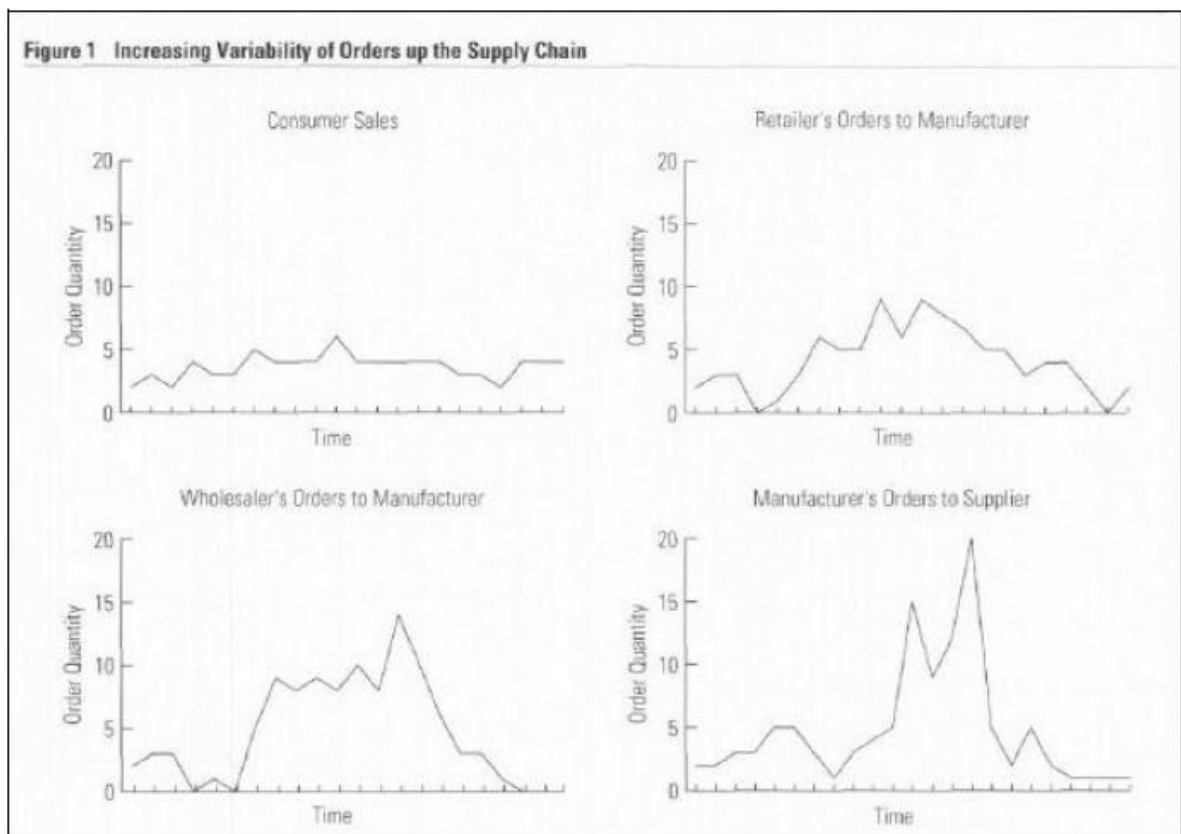


Figure 1. Increasing Variability of Orders up the Supply Chain (Lee et al., 1997)

The mismatch between demand and supply, measured as the combination of inventory carrying costs, inbound service levels (proportion of orders filled by the manufacturer against orders placed by 3PL, usually measured in case quantities), outbound service levels/order fill rate (proportion of orders filled by the 3PL against orders received from retailer, usually measured in case quantities) and stock outs (lost sales) are growing in many industries. Through better demand forecasting, improved production and inventory planning, increased production capacity, reduced transportation lead times and strategic customer relationships, like VMI, organisations have endeavoured to tame the BWE (Pamulety and Pillai, 2011).

2.5. Impact of the Bullwhip Effect on Forecasting

Forecast accuracy is a measure used for judging the efficiency of the forecasting process. In essence forecast accuracy is the comparison of forecasted sales against actual sales. At best, forecasts are educated guesses about the future. The business advantage of forecasting according to Taylor (2004) is that it eliminates predictable variability from the future demand stream, allowing for production to be planned much more precisely.

Factors that affect forecasting include sales demand patterns, economic conditions, competitor actions, market research, product mixes, and pricing and promotional activities. Forecasts can be prepared at different levels within an organisation, strategic, tactical, and operational. Several authors have considered the relationship between forecasting and the BWE. Metters (1997) stated the significance of the BWE in monetary terms and proved that forecasting is one of the main motives of the BWE. Results of his research indicated that eliminating forecast errors may increase profitability. In addition, Metters (1997) further asserted that a lack of inter-company communication combined with large time lags between receipt and transmittal of information is at the root of the problem.

Hanssens (1998) illustrated that the BWE exists as a result of forecasting and measures the impact of the effect. Chen et al. (2000) made important contributions by focusing on quantifying the impact of demand forecasting on the BWE for a simple, two-stage supply chain consisting of a single retailer and a single manufacturer. They measured the magnitude of the bullwhip effect under different forecasting techniques such as exponential smoothing and moving average. They extended these results to general multi stage supply chains, in the case of both centralized and decentralized customer demand information (Sun and Ren, 2005). The results showed that the variance of orders placed by downstream members will be higher than the variance of demand, if the downstream

member periodically updates the mean and the variance of demand that is based on observed customer demand data. Sun and Ren (2005) concluded that the BWE is due, in part, to the retailer's need to forecast. Their research demonstrated that the increase in variability will be greater for longer lead times. However, the size of the impact does depend on the forecasting methods. Kittiwat Sirikasemsuk and Luong (2017) also analysed the BWE for a two-stage supply chain with one supplier and two retailers. The main focus of the research was to quantify the BWE using an analytical approach in which the minimum mean square error forecasting method and the base stock policy were applied to all members of the supply chain.

2.6. Information Sharing and the Bullwhip Effect

It is widely acknowledged that the BWE is largely caused by the variability of ordering. Naude (2009) explains that a major difficulty in balancing supply and demand is the matter of production based on forecasts. To mitigate or eliminate the variability, information sharing between members of the supply chain should be increased to reduce the uncertainty (Du et al., 2017, Wang and Disney, 2016, Dai et al., 2016, Yu et al., 2001). In a supply chain consisting of a single retailer and a single manufacturer Chen et al. (2000) demonstrated that the BWE can be significantly reduced by centralizing the demand information, but cannot be removed in its entirety. A two stage supply chain was developed by Lee et al. (2000) in an attempt to quantify the benefits of information sharing. Their analyses suggest that information sharing alone could provide significant inventory reduction and cost savings to the manufacturer.

Lee and Whang (2000) recommended that by the retailer sharing sales information with the supplier, the supplier is better able to prepare for market demand. Cachon and Fisher (2000) quantified the value of such sharing. McCullen and Towill (2001) researched supply chain efficiency and use information transparency system as one of the approaches to reduce the bullwhip effect which consists of high information integrity

between supply chain members. By focusing on how point of sales data can tame the BWE in a multi-tiered supply chain, Croson and Donohue (2003) found that the magnitude of order oscillations can lessen if point of sales information is applied across the supply chain.

With the goal of SCM being a reduction in inventory levels and associated costs, increasing profitability and improving coordination, the question becomes what type of information should be shared in the achievement of this goal, without the perceived loss of power. Confidentiality of shared information is an added concern associated with information sharing (Lee and Whang, 2000). Various types of information can be shared across the supply chain 1) Inventory Information 2) Sales Data 3) Sales Forecasting 4) Order Information 5) Product Ability Information; and 6) Exploitation Information of New Products. Sharing of inventory information is the most common among members as it avoids stock outs and stock repetition. Lee and Whang (2000) argued that by sharing sales forecasts information the BWE and its related inefficiencies can be eliminated by avoiding independent multiple forecasts. More specifically, information lowers uncertainty arising from changes in orders, demand volatility, and lead-time fluctuations, and, therefore, acts as a substitute for inventory (Vanpoucke et al., 2017).

As can be seen from the literature review, well-managed supply chains represent a competitive advantage and are a major lever of overall firm performance (Jeschonowski et al., 2009). It is a strategic imperative demanding the attention of senior management. The only real solution to the variability problem is for trading partners to work together to remove variability across the chain, rather than trying to cope with variability through point solutions such as added safety stock (Taylor, 2004). Mastering demand, rather than managing it will be the basis of competitive advantage in the supply chain. Taylor (2004) affirms that an organisation should shift its thinking about demand from a conventional,

reactive stance to a more proactive point of view, understanding that the demand can be shaped to fit the competitive advantages of the supply chain.

CHAPTER 3

RESEARCH METHODOLOGY

3.1. Introduction

The research design followed in this study was qualitative in nature and follows the case study methodology (Leedy and Ormrod, 2013). The objective of this study was to determine if the misalignment within a supply chain between supply and demand can be reduced through information sharing, and to identify the changes needed to achieve this goal. This research study was exploratory in nature and the results of the study could be used to optimise supply chains.

3.2. Purpose

The purpose of this study was to identify the key drivers of demand variability, and to determine whether the misalignment within a supply chain between supply and demand can be reduced, and the benefits quantified.

3.3. Overview of method

An in-depth analysis of the supply and demand alignment of a manufacturer, a distributor and a retailer in a supply chain was performed. As this was an exploratory study, data was gathered from a variety of sources and by using several different methods. Contractual agreements, operational procedures and policies were examined to provide insight into the current situation. Historical data (point of sales, promotional and non-promotional items, stock days, service levels) from the manufacturer, distributor and retailer were inspected to understand the impact of demand variability. Observation of the current practices was used to determine the behaviour of the respective members. The analysis focused on the current situation and potential areas of improvement, based on the findings of a single product being traced through the supply chain with no information sharing. Semi structured in-depth interviews were conducted with key

decision makers involved in the alignment of supply and demand management in the supply chain.

From the review of the documents, the observations carried out by the researcher and the semi-structured interviews a case study emerged. Yin (2009) explains that the case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion. Case studies also benefit from the prior development of theoretical propositions to guide data collection and analysis. In this case, the theoretical proposition that will guide the study is based on the BWE and SCM principles.

3.4. Case study

The case study was performed on Imperial Cold Logistics (Pty) Ltd (ICL), a specialist provider of logistics and SCM of chilled and frozen products to the Fast-Moving Consumer Goods (FMCG), retail and wholesale industries in South Africa and Lesotho. The company's core business focus is effective warehouse management, inventory management and distribution solutions. The cost-effective business model offers a synergised, shared service platform to food manufacturers thereby equitably distributing the costs of supply chain activities through one service provider. Operating from six distribution centres across South Africa, ICL has built a reputation of high quality service, in an effective and efficient way (ImperialColdLogistics, 2017).

The case study focused on one retailer (PnP), one manufacturer (Lancewood) and one distributor (ICL). The commercial contract between Lancewood Holdings (Pty) Ltd (a manufacturer of cheese and dairy products in South Africa) and ICL is one of principal agency, where Lancewood is the principal and ICL is the agent. As the agent, ICL provides Lancewood with national services for forecasting and procurement of their

products, EDI and/or Telesales order capturing, warehousing, distribution, reverse logistics and debt collection in South Africa. ICL acquires Lancewood products at the cost price. Lancewood is responsible for the determination and negotiating of the list and deal prices for the products, with the customers i.e. retailers. The difference between the list price and cost price is the commission ICL earns for the rendering of services. If there is a deal/promotion period with a customer, ICL is entitled to recover from Lancewood any shortfall between the list price and the deal price in respect of the products and to affect the claim back of any such shortfall. Lancewood must advise ICL of the list price and agreed deal price of the products and Lancewood is responsible to capture and maintain these negotiated prices into ICL's electronic pricing system. Stock held by ICL will automatically be re-valued in accordance with any changes in the pricing. Ownership of the products remain with Lancewood and never passes to ICL even whilst stored in ICL's warehouses or transported in ICL's vehicles. Only upon delivery to the customers, does ownership of the products simultaneously pass from Lancewood to the customer. ICL earns its commission only at the point where the onward sale to PnP occurs.

ICL is dependent on EDI orders it receives from Pick n Pay Stores Ltd (PnP), a major retailer in South Africa and the fulfilment of these orders from Lancewood. Currently, forecasts are prepared independently by PnP using point of sales information as the main source of data with adjustments to promotional and non-promotional products. PnP only shares orders (output of their demand planning process) with a 24 and 48-hour lead time with ICL as opposed to sharing any of the forecast information. This means fulfilment of these orders must be issued from available stock on hand. This in itself is problematic as ICL is forced to hold excess stock in the event that EDI orders are received for specific products. In many instances stock ordered by PnP is not on hand resulting in lost sales, and in other instances orders are not received for stock held by ICL. It can be said that ICL is the thread connecting the inbound and outbound flows between Lancewood and PnP. Because of limited information sharing ICL has a high inventory cost so as to

minimise the risks of running out of stock and maintain high customer service levels through increased inventory levels.

Even though the forecast information from PnP is provided directly to Lancewood, little is done by Lancewood in utilising these forecasts for production planning. Lancewood is reliant on the purchase orders it receives from ICL, (which represents retailer demand) for its production planning. One of the reasons why the forecast information is disregarded by Lancewood is that they are focused on their core competence which is production. The accuracy and coordination of forecasts are seen to be a non-core activity.

3.5. Sources of data

Data can be defined as the facts presented to the researcher from the study's environment (Cooper and Schindler, 2003). For the purposes of this case study, multiple sources of data were used.

- The following data was extracted from ICL's demand management system (Optimiza) for a 12-month period.
 - Historical retailer point of sales information, promotional and non-promotional period
 - Retailer forecast information
 - Stock availability and stock days
 - Manufacturers forecast information and production schedule
 - Inbound and outbound service levels
- Examination and documentation of existing contractual arrangements, operational procedures, control systems and policies of each of the entities in the supply chain.
- Observation of the behaviour of key decision makers in the supply chain as they carry out their day to day jobs.

- Semi-structured in-depth interviews were conducted with key decision makers involved in the alignment of supply and demand management at Lancewood, ICL and PnP.

3.6. Collection of data

The researcher collected and examined an assortment of documentation (contractual agreements and operating policies), observed the behaviour of demand planners as they carried out their duties and interviewed key decision makers involved in the alignment of demand and supply at the various entities. According to Yin (2011), data serves as the foundation for a research study. In qualitative research, the relevant data is derived from four field-based activities: observing, collecting and examining, feeling and interviewing.

3.6.1. Supply Chain Simulation

To illustrate the benefits of information sharing, actual historical demand information was collected for a single product (900-gram Lancewood Gouda Cheese), three-stage decentralised supply chain comprised of Lancewood, ICL and PnP. This product was traced through ICL's supply chain without any information sharing. Orders received by ICL from PnP either have a 24 or 48-hour lead time, which means fulfilment of these orders must be issued from available stock on hand.



Figure 2. Model of Supply Chain and Current Order Flow

The same 900-gram Lancewood Gouda Cheese was then traced through the same supply chain however in this scenario not only were the EDI orders shared with ICL but

so too was the forecast information. The forecast information comprised of current EDI orders (24 or 48-hour lead time) along with a six-week future sales plan including upcoming promotional and non-promotional items (future sales with a lead time longer than 24-48 hours).

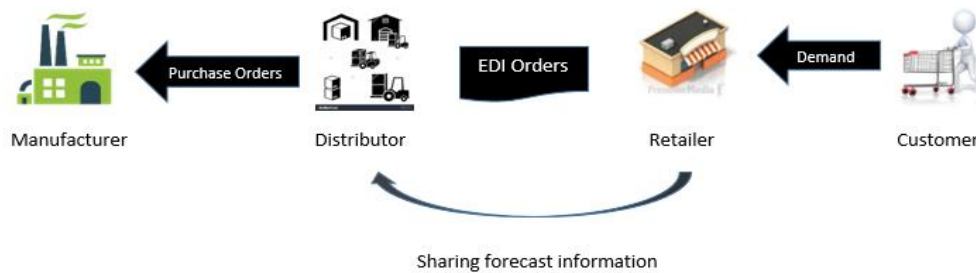


Figure 3. Model of Supply Chain and Order Flow with Information Sharing

By means of the demand, supply and inventory planning system, Optimiza, employed by ICL, the impact of the BWE on the supply chain was quantified under both scenarios, i.e. with and without information sharing. The performance measurements used to evaluate the impact across the chain were inventory carrying costs, inbound and outbound service levels and stock outs (lost sales).

3.6.2. Semi-structured Interviews

In addition, the researcher conducted semi-structured interviews as a means of collecting data. The information was collected through personal and telephonic interviews. Questions were modelled on the research questions, aims and themes identified in the literature. Semi-structured in-depth interviews were conducted with key decision makers within Lancewood, ICL and PnP that are involved in the alignment of supply and demand management on a daily basis. Permission was granted to conduct interviews with the following people:

- Adri Tarantino, ICL Supply Chain Manager
- Inge Human, PnP Supply Chain Planning – Perishable, Eggs & Cheese National

- Chris Bester, ICL Operations Director
- Chris de Beer, ICL Commercial Director
- Jacques Hill, Lancewood Sales Director
- Landford Scheepers, Lancewood Supply Chain Manager

Permission was granted to publish the names and details of all parties involved in the case study.

3.6.3. Development of interview questions

In developing the interview questions, the researcher considered each member's role in the supply chain. Based on their relative position within the chain, three questionnaires were developed i.e. supply management, demand management and logistics management. In-depth questions developed were in support of the overall research questions i.e. to identify the key drivers of demand variability and to determine whether the misalignment within a supply chain between supply and demand can be reduced and the benefits quantified. The questionnaires that were developed are in Appendix G, H and I.

3.7 Data Analysis

A database was created using electronic files. Organising the data was beneficial to analysing the database. Contractual agreements, operational procedures, control systems and policies were obtained from each member in the supply chain so that they could be documented and analysed. The researcher developed a consistent template to analyse the historical data (point of sales, promotional and non-promotional items, stock day and service levels).

Interviews were recorded and transcribed. Re-reading the interviews and observations assisted to familiarise the researcher with the data collected. The researcher extracted themes present in the interviews with reference to the literature on the BWE and supply

chain theory. The researcher listed all themes identified and presented them in relation to one another. The final stage of data analysis involved the production of a summary text of the structured themes, together with direct quotations that illustrate each theme.

3.8. Validity and reliability

To ensure the validity of the study, the evidence collected and the conclusions drawn need to stand up to scrutiny in order to minimise errors and biases in the study (Kruger et al., 2005, Yin, 2009). Data was collected using standardised procedures and interpreted so that the results accurately reflect how the misalignment between supply and demand can be reduced through information sharing. One of the main approaches used to achieve this is through triangulation of all data in the case study. The researcher shared her findings with the key decision makers in the supply chain to validate the findings and obtain further insights from them. The data was also analysed with reference to the SCM literature. All supporting material will be made available and will be kept for the necessary time for scrutiny to ensure that claims are valid.

CHAPTER 4

RESEARCH FINDINGS

4.1. Introduction

The research study focused specifically on the alignment between supply and demand for ICL, which is the fundamental cornerstone of the logistics processes. The research design was performed under actual environmental conditions. Extensive literature exists concerning the importance of aligning the demand and supply side of a supply chain, most of which identify the major benefits of improved alignment. However, little research has been done on the alignment of the supply and demand within a supply chain (Cooper and Schindler, 2003). Secondary literature and semi- structured interviews were used to collect research data on the alignment of supply and demand within a supply chain.

4.2. Semi-structured Interviews

While published data is a valuable resource, no more than a fraction of the existing knowledge in a field is put into writing. A significant portion of what is known on a topic may be proprietary to a given organisation and thus unavailable to an outside researcher (Cooper and Schindler, 2003). Therefore, conducting semi-structured in-depth interviews with individuals experienced in the alignment of demand and supply at Lancewood, ICL and PnP was key to obtaining relevant information. The outcome of the semi-structured in-depth interviews was to gain insight from Lancewood, ICL and PnP on what they perceive the key drivers of demand variability to be and their attitude toward mitigating the impact.

4.3. Supply Chain Simulation

Using EDI, the PnP Frozen Distribution Centre (FDC) in Gauteng transmits orders to ICL who in turn communicate these orders to Lancewood by way of purchases orders. Before ICL can communicate these orders to Lancewood, the requested orders are entered into

Optimiza, along with a three-month rolling sales forecast that is updated weekly by Lancewood. Optimiza uses advanced algorithms to calculate what the required order to Lancewood should be by combining the current order, forecasted future sales and available stock in ICL's network. If stock is available in ICL's network but there are no forecasted future sales or orders for the product ICL actively engages with Lancewood to either arrange a promotion with a retailer or uplift the stock to avoid stock write-offs given the short shelf life of certain products.

Having a solid set of measures in place to monitor performance is one of the answers to improving supply chain operations. With an abundance of measures available, the challenge lies in selecting the suitable measure. Organisations have fallen into the trap of trying to measure too much, overwhelming themselves with information that never forms a complete picture. The opposite is also true, where organisations measure too little and rely on only a few gauges that do not reflect the full spectrum of performance (Merwe, 2005). Organisations are also led astray by the prevailing management fads, forcing them to focus too narrowly on these measures.

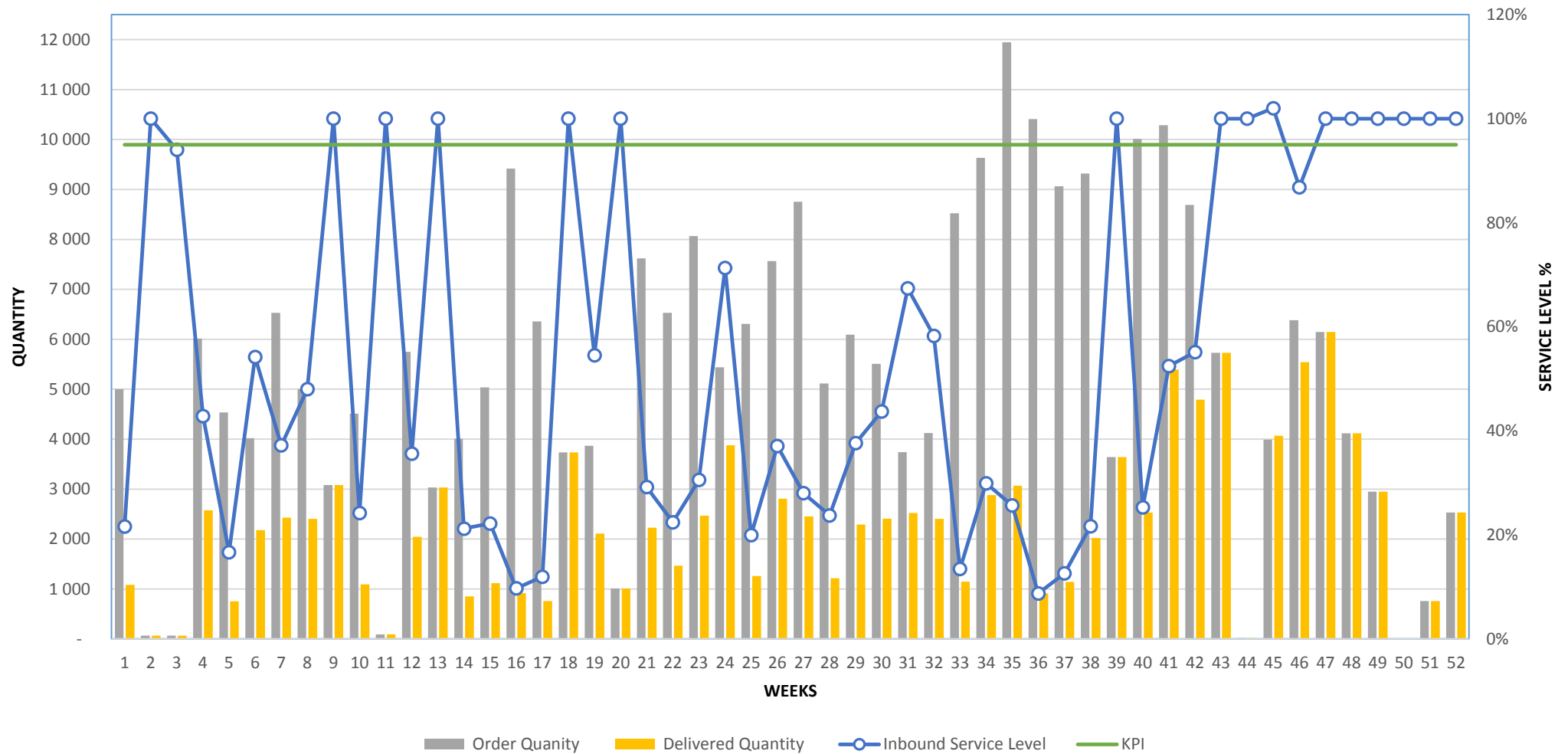
ICL employs several performance metrics to measure both the effectiveness and efficiency of the supply chain, however for the purposes of this study the research focused specifically on the inventory carrying costs, inbound and outbound service levels and stock outs (lost sales). By comparing the proportion of orders filled by Lancewood against the orders placed by ICL inbound service levels can be measured. The key performance indicator (KPI) that Lancewood should achieve is between 95 – 100 % for inbound service levels, in turn ICL should achieve the same outbound service levels. Outbound service levels are measured as the proportion of orders filled by ICL against orders received from PnP. Orders are usually measured in case quantities. Understandably a relationship exists between inbound and outbound service levels, meaning outbound service levels will be impacted should there be an inability to provide the required inbound demand.

Using ICL's actual historical sales data from 1 January 2017 – 31 December 2017 for the 900-gram Lancewood Gouda cheese, the graphs that follow show the actual inbound, actual and simulated outbound service levels and stockholding for the period.

4.3.1. Inbound Service Levels

Graph 1 graphically presents the actual inbound service levels for the period 1 January 2017– 31 December 2017. The inbound data was extracted for all Lancewood customers ordering the 900-gram Gouda cheese into ICL's Johannesburg distribution centre. ICL measures inbound service levels differently in that the measurement is per distribution centre and not per customer whereas outbound service levels are measured for a specific customer i.e. PnP FDC. Inbound service levels for the period averaged only 55.71%, which is well below the desired KPI of 95%. Week 16 and 36 had the lowest service level percentage, amounting to 9.72% and 8.74% respectively. In week 36, the order quantity demanded by ICL was 10 410 cases of Gouda cheese however Lancewood's delivered quantity totalled 910 cases only. Achievement of the inbound KPI of 95% and above was only reached for 16 weeks during the 2017 year by Lancewood.

Actual Inbound Service Levels



Graph 1: Actual Inbound Service Levels with no Information Sharing

One of the reasons for the erratic service levels is because store promotions were not communicated to both Lancewood and ICL. With the increased demand there was insufficient stock to satisfy the need, resulting in the variability. In addition to the above, and the largest contributor to the variability is that Lancewood was unable to produce the required demand due to a shortage of raw material. With the longer production time needed to manufacture gouda cheese coupled with a shortage of raw material the factory was incapable of producing the required demand thus impacting service levels negatively. Had the promotions been communicated timeously Lancewood could have acted to redirect raw materials to the production of the Gouda cheese (this decision would have to consider the opportunity cost of the foregone products) or look for alternate means to source the raw material. Lancewood did declare that “the factory’s ability to adapt to immediate changes in demand is lethargic – every 2 weeks. Accurate forward forecasts (promotional), production capacity, bulk availability, distribution and warehousing capacity are just a few constraints influencing our reaction time.”

It was not ascertained whether PnP knew about the raw material shortage. However, it was found that PnP, in trying to manage demand and being aware of an impending shortage or surplus in supply, favour products with longer shelf lives because they are better candidates to bulk up for periods when there may be a shortage. However, PnP face their own challenges in that the distribution centres mainly work on a flow through basis, meaning stock comes in the one day and goes out the next, making it difficult to hold bulk inventory for times of shortages or taking advantage of temporary price discounts. PnP further acknowledged their difficulty to allocate excessive amounts of stock in times of surplus supply due to the rate of sale per store not allowing for it as it will cause overstocks in the distribution centres.

This variability of demand illustrates the BWE described by Forrester (1958), Sterman (1989) and Lee et al. (1997). During the interview process with Lancewood it was found

that the trigger for their supply chain are the orders received from ICL and not the forecast information provided by PnP. This alone is the key determinant of demand variability as illustrated by Metters (1997). If Lancewood triggered their supply chain on the PnP forecast rather than the orders received from ICL the demand variability will be substantially reduced. Further, Landford Scheepers, the Supply Chain Manager at Lancewood conceded that “we are still busy with the forecasting process and have not yet reached the maturity levels to effectively utilise the information, thus, in many cases we try and manage the demand when service levels are impacted negatively.”

During the interview conducted with Inge Human the demand planner at PnP it was found that “suppliers are mainly involved in the planning of promotional lines, where a forecast will be sent to them a few weeks before the promotion starts. They can raise any concerns if any misalignment is picked up.” There have been occasions where Lancewood used PnP’s promotional data for production planning, the stock transferred to ICL’s network, but the promotion did not happen. Consequently, because of the commercial terms ICL is saddled with excess stock in their network along with the burden of working capital. There is a further risk, even though smaller for hard cheese, around product expiration dates.

Chris de Beer, Commercial Director at ICL explained that “historically ICL attempted to understand what Lancewood’s sales target for a year was but never really understood what PnP’s targets were. ICL then developed their own sales targets/forecast based on their own understanding of the supply chain. This stems from the fact that Lancewood would have included too much growth in their numbers because they want to grow the brand, and if ICL did not achieve these targets their profit targets would be at risk. Additionally, if ICL used Lancewood’s forecast which was known to be inflated it would result in over planning for capacity. ICL adopted a conservative approach by generating their own forecasts.”

ICL has a high operational gearing structure attributable to large investments in warehouses, vehicles and technology. The nature of the contractual agreements in place means that ICL has a great dependency on volumes (throughput), which is at the core of their revenue generation. The high operational gearing can work both ways for ICL. During peak periods, this works to ICL's advantage given the steady throughput, conversely during periods of decline this poses a problem. The movement in volume causes rapid swings from profitability to loss within weeks. Given the volatile and unpredictable nature of the FMCG sector, the steady and consistent flow of volume is by no means guaranteed, even during peak periods. Previously it was assumed with a fair degree of certainty that during these periods there would be a surge in demand, this is no longer the case.

Not knowing what true demand is will result in idle capacity and superfluous investments in infrastructure. In this example of the 900-gram Gouda cheese, ICL is not saddled with excess stock given the product demand, however, certain Lancewood product lines remain in ICL's network for 8-10 weeks, well over the contractual stockholding of 14 calendar days. Although the commercial agreement allows for storage fees to be levied, the cost is not fully recovered. The solution is not to levy storage fees but to ideally reduce the stock in the supply chain, because it takes space where ICL could generate revenue for other manufactures, which is held up with Lancewood given the inefficient supply chain. Naude (2009) emphasizes that inventory can be reduced by reducing variability in the supply chain and/or quicker responding supply chains. If true customer demand was known and understood with some degree of certainty, ICL could perform a network analysis to pursue the most effective way to serve its customers.

The impact of the inability of Lancewood to meet the inbound service levels is illustrated in Appendix A. By applying the 2017 cost price of R 442,89 per case and comparing actual order quantity against actual delivered quantity, lost sales for Lancewood can be

quantified for the period. Lancewood's failure to supply the inbound demand resulted in lost sales of R 71 734 008 just for the 900-Gouda cheese for 2017. These amounts were calculated based on all the requests from customers into the Johannesburg distribution centre of ICL.

4.3.2. Outbound Service Levels

Graph 2 graphically depicts the actual outbound service levels to the PnP FDC for the period 1 January 2017– 31 December 2017. Outbound service levels for the period averaged 80.06%, which is still below the desired KPI of 95%. Even though the inbound service levels were severely compromised by a shortage of raw material, ICL was still able to satisfy 80.06% of the demand, this is because of the safety stock kept in the ICL network.

Week 4 (9.38%), week 12 (8.30%) and week 18 (0.05%) yielded the lowest outbound service level % for the period. In week 18, PnP demanded 2044 cases however ICL was only able to supply 1 case, meaning that this was a sale from stock on hand and Lancewood was unable to manufacture the required order to satisfy the demand. Achievement of the outbound KPI of 95% and above was reached for 28 weeks during the 2017 year by ICL.

The influence of lead times should not be underestimated. Orders are received daily (Monday – Friday) from the PnP FDC and either have a 24 or 48-hour lead time, meaning that orders received on a particular day must be delivered the following day or the day after but before 5pm. The order cut-off time is 11:00am daily and with the short lead time to deliver stock, ICL must either have sufficient stock in their network to meet the demand or order the required stock from Lancewood. There are situations where stock ordered from Lancewood arrives well after the nominated delivery day thus contributing to lost sales. Stockholding will then appear inflated because the delivery order was missed.

Because of the causal relationship that exists, outbound service levels will be unfavourably impacted by the inability to supply the inbound demand.

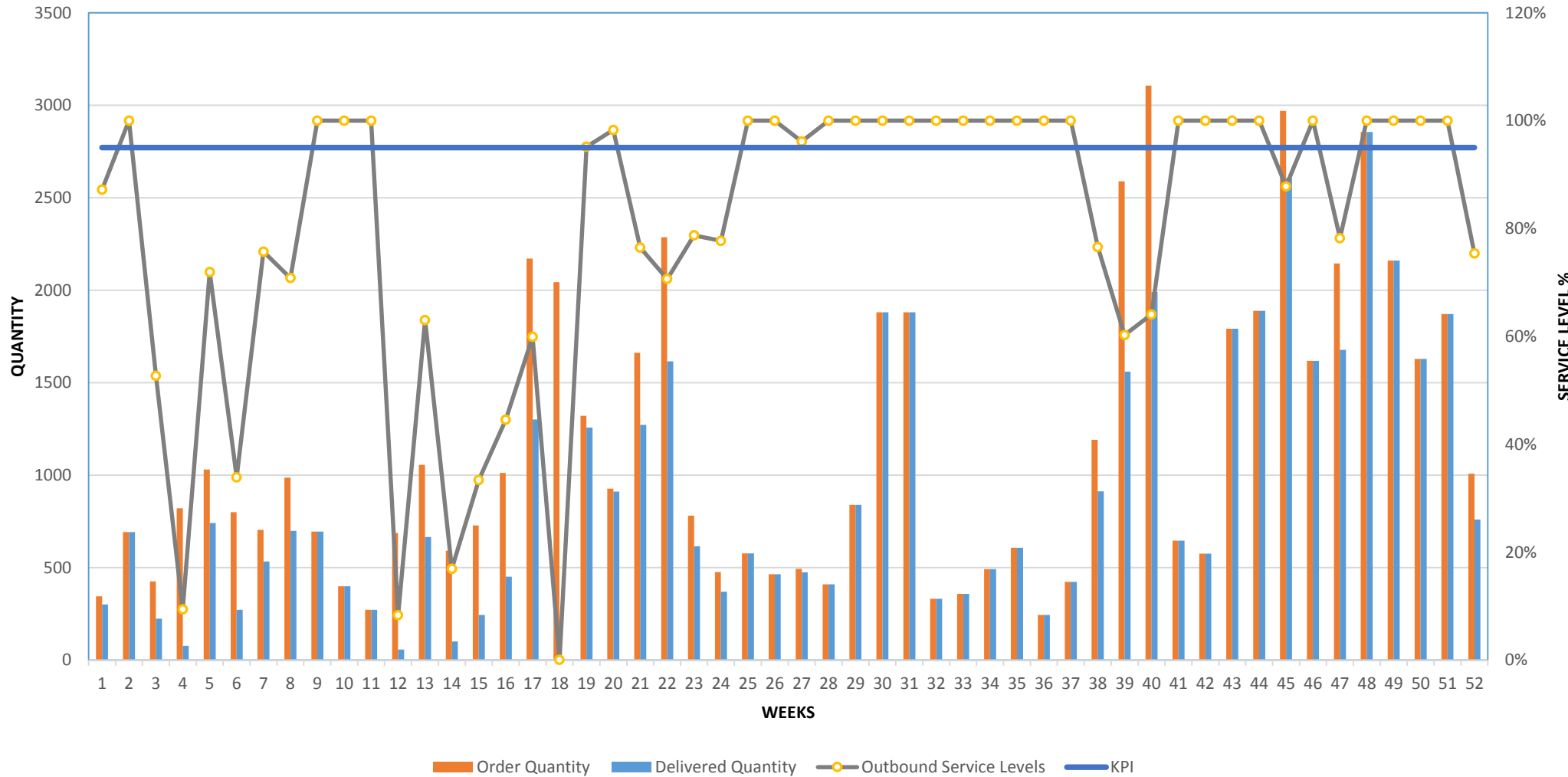
The data exemplifies that independent and unsynchronised retailer demand leads to uncertainty in the supply chain. A more impactful approach of alleviating uncertainty is if all three parties connect on one forecast. Chris de Beer suggests that “all three parties connect on one forecast, not an annual forecast, but a forecast for 2 weeks and near time accurate stock levels. Now Lancewood has their own forecast, same with ICL and PnP does their own thing. ICL and Lancewood are reasonably connected but we are disconnected from PnP. If we can agree on a tripartite forecast, for 1 week, 2 weeks and 6 weeks that would make a difference because we are not aligned on the forecast and we miss each other’s targets. PnP and Lancewood possibly aligned on the exceptional items, e.g. promotions, 900-gram cheese both are aware of the expectations but on the remaining basket no connection. Whereas ICL’s alignment with Lancewood is the balance of the basket and then we add what’s been agreed with PnP, but there too we negotiate and give our own input, therefore the forecast is never aligned overall. Opportunity to align one proper forecast per SKU across all three parties. Most realistic way of aligning the forecast is for a Lancewood key account manager to meet with the demand planning team at PnP to agree a forecast and once that is signed off to share it with ICL.”

Forecasts are used as a tool to predict demand and manufacture stock in anticipation of the demand. However, alternate approaches to demand management must be considered, necessitated by the fact that the market place today is volatile and less predictable. Acceptance that the supply chain is driven by market demand (customers), not suppliers is the first step. Second, is acknowledging that information must be substituted for inventory and thirdly, organisations must become more agile in responding

to real demand by having agile supply chains. This further supports the need for strategic alliances in the supply chain (Li and Lin, 2006, Christopher and Peck, 2012).

Competitor activity is another factor driving demand variability. In this study of a three-stage supply chain both Lancewood and ICL aren't aware of what their competitors are doing, only PnP is. Suppose Clover has a promotion on with PnP at the same time as Lancewood. If Clover cheese is priced lower than Lancewood cheese, it can be assumed that the Clover cheese would sell out faster. A further contributor is the availability of fresh stock in stores. If there are batches of fresh stock in stores that are about to expire, the regional buyers could promote these items at a lower price, that would also cause a flare up in sales, but that is for a specific reason. It's not because the consumers demanded it, it's because the stock is about to expire. In the sales forecast for the next week there will be a massive spike on sales. With better information sharing it should be possible to better plan and thus avoid the negative impact of unilateral decisions by the members of the supply chain.

ACTUAL OUTBOUND SERVICE LEVELS

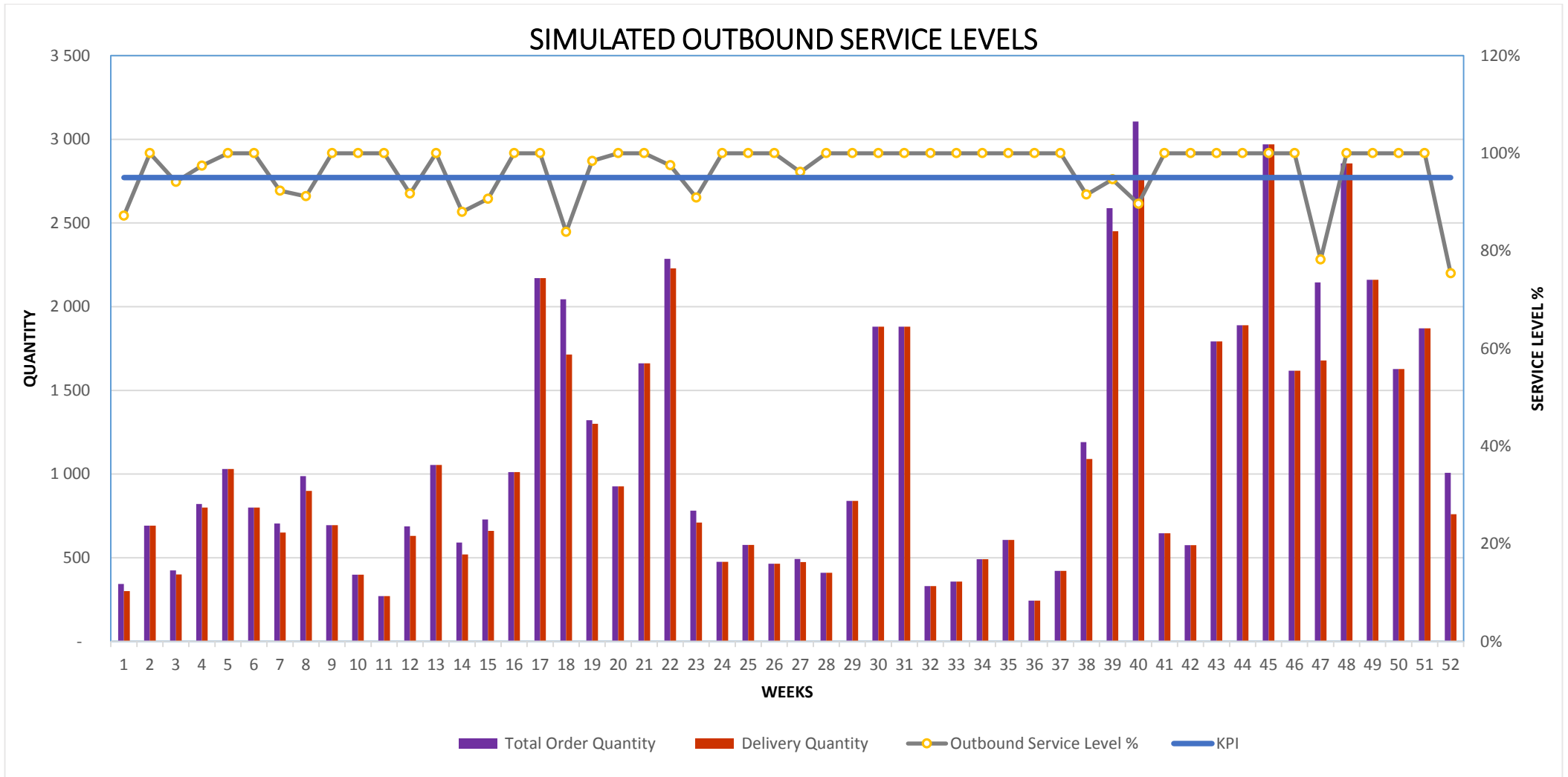


Graph 2: Actual Outbound Service Levels with no Information Sharing

4.3.3. Simulated Outbound Service Levels

Graph 3 simulates what the outbound service levels to PnP would have been had the store promotions (which is one of the inputs in generating the forecast) been shared with both ICL and Lancewood. This simulation considers the actual available stock in the ICL network to satisfy the required promotional demand. Average simulated service levels for the period are much improved to 96.71%. This is a 16.65% improvement compared with actual outbound service levels. By applying the 2017 list price of Lancewood 900-gram Gouda cheese of R 473,68 per case and comparing actual outbound delivered quantities with the simulated outbound deliveries quantities, lost sales for the period can be quantified for ICL, as illustrated in Appendix B.

Studying the actual outbound service levels for the 2017 period showed that ICL was unable to satisfy PnP's demand resulting in lost sales of R 6 001 526 with an associated actual outbound service level of only 80.01%. The simulated outbound service level data proved the positive impact information sharing can have on the supply chain. In this example, lost sales for ICL could have reduced by R 4 958 482, improving service levels by 16.65% if the promotional activity information was simply shared.



Graph 3: Simulated Outbound Service Levels with Information Sharing

As can be seen in Appendix C, by applying the 2017 cost price of Lancewood 900-gram Gouda cheese of R 442,89 per case and comparing actual outbound delivered quantities with the simulated outbound deliveries quantities, lost sales for the period can be quantified for Lancewood. In addition, Lancewood would also benefit, reducing their lost sales from R 5 611 416 to R 975 244.

This simple example illustrates the benefit of information sharing. Sharing just the promotional information for the 900-gram Gouda cheese would have resulted in increased sales of R 4 958 482 for ICL (Appendix B), increased sales of R 4 636 173 for Lancewood (Appendix C) and PnP. Increased sales in just one of the associated benefits. Literature is replete with the benefits of information sharing (Cachon and Fisher, 2000, Chen et al., 2000, Croson and Donohue, 2006, Pamulety and Pillai, 2011, Yu et al., 2001).

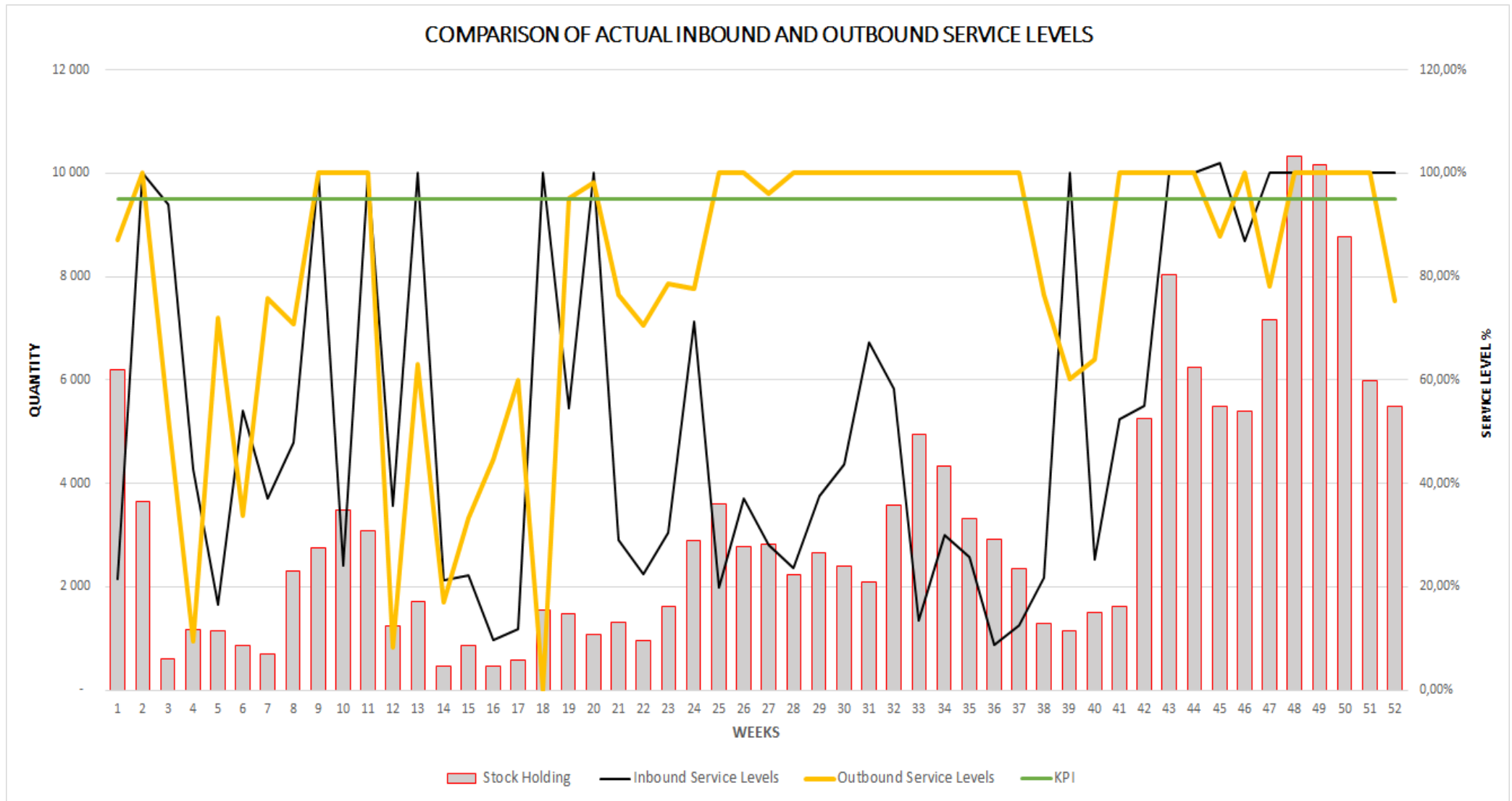
While inventory level information is available and readily disclosed among the supply chain partners, it was discovered through the interview process that additional information, if obtained would go a long way to reduce demand availability. Information of value suggested by Lancewood, ICL and PnP were point of sales data, possible supply issues, promotional activity and periods and enhanced historical data. A further consensus derived from the interviews was that the retailer information (forecasts, point of sales data, promotions etc) must be incorporated into the collaborative forecast. The agreed upon forecast must be built from the lowest level which ultimately culminates into Lancewoods production plan. PnP intimated their willingness to share their medium term 4 week forecast with Lancewood and ICL to align it with the production planning process.

4.3.4. Comparison of actual inbound and outbound including stock holding

Combining actual inbound and outbound services together with the average stockholding for the period, the variability of demand is apparent, as seen in Graph 4. This demonstrates the amplification of demand upstream described by Forrester (1958).

Studying week 25 to week 37 illustrates higher outbound service levels compared to the inbound service levels. The reason for this improvement is because ICL had the required stock to fill the relatively low sales order. Appendix D calculates the average inventory carrying cost for the year, being R 1 414 931 equivalent to 3 195 cases. In this example, ICL is not burdened with excess inventory due to the product demand. The principal agency agreement that exists between Lancewood and ICL means that ICL only earn its commission once the onward sale to PnP has happened. Appendix E quantifies the reduction in lost commission to ICL between the actual and simulated outbound service levels. As can be seen the extra commission that could have been generated for ICL amounts to R 322 310 for the year.

What is apparent from the data is the supply-side and demand-side can no longer be viewed in isolation, organisations must focus on more than just supply-side efficiencies to achieve revolutionary SCM. Gattorna (1998) reiterates that organisations also need to integrate their demand and supply regimes to build a platform for achieving competitive advantage. The authour goes on to say that demand defines the supply chain target, while the supply-side capabilities support, shape and sustain demand.



Graph 4: Comparison of actual inbound and outbound service levels including stockholding

4.4. Discussion of findings

4.4.1. Key drivers of demand variability

Carefully studying ICL's actual inbound service levels and outbound service levels including stockholding for the 2017 year reveals that the BWE exists in the ICL supply chain. All members i.e. Lancewood, ICL and PnP are affected to some extent. Appendix F summarises what Lancewood, ICL and PnP consider to be the key drivers of demand variability in order of importance

To increase their competitive advantage, organisations use promotions as an instrument to increase consumer demand. Promotions however, top the list for all three members in this study as the main contributor of demand variability. The actual data illustrates the demand variability caused by promotions and the simulated data illustrates the opportunity for all members in the supply chain if promotions are shared. Gattorna (1998) explains that the primary causes of demand volatility are terms of trade, promotions and pricing, specific company policies, and distribution channel structure.

The inbound service levels into ICL's network is the responsibility of Lancewood, however, it was discovered that Lancewood triggers their supply chain from the orders received from ICL and not the forecast information provided by PnP. This is one of the drivers of demand variability between Lancewood and PnP, which has a bearing on ICL. In addition to the above it was found that PnP only shares orders (output of their demand planning process) with a 24 and 48-hour lead time with ICL as opposed to sharing the forecast information. The ideal situation is for all three members to agree on what the supply chain trigger is.

From the extensive literature review undertaken, it is acknowledged that the dynamics of the marketplace has been transformed in recent years. The power has shifted from the manufacturer to the customer, meaning that the trigger for the supply chain must be

customer demand. Once this is understood and agreed, information sharing must follow to support strategic alliances.

4.2.2. Changes to procedures, information sharing and controls

Because organisations are no longer in control of their overall performance (Akkerman and Dellaert, 2005), current controls and procedures must be reviewed. Equally, through the interview process it was found that the current controls and procedures between Lancewood, ICL and PnP seem to hinder information sharing rather than to promote it. This sentiment was shared with all parties when questioned. Lack of trust also seems to be a central theme and the reason why Lancewood does not use the information from PnP to generate forecasts (Li and Lin, 2006). Controls and procedures exist to safeguard organisations by mitigating risks; however, this should not be at the expense of potential revenue generation for organisations. If controls and procedures are too cumbersome it could unknowingly add complexity to the supply chain making it difficult to manage. Taylor (2004) describes that the difficulty of managing supply chains comes primarily from the complexity that creeps into their structure and the variability that characterises their flows.

Further, given the changing landscape of the market place, organisations should endeavour to review controls and procedures to ensure they are not antiquated and form a barrier to information sharing. Christopher (2011) explains that the lines between suppliers, customers and competitors are sometimes becoming increasingly blurred. To effectively operate in this blurriness, organisations must transition from working in silos to collaborative strategic alliances. A total supply chain solution must be considered to resolve the problem of variability, meaning supply chain partners must work together to remove variability in the chain. Reality is, organisations no longer operate in isolation, they must engage in collaborative partnering to succeed.

Mastering demand rather than managing it will be the critical success factor. Now, both ICL and Lancewood are reactive, rather than proactive in managing demand. The aim should be to connect with PnP and reached consensus on 1) the trigger for the supply chain, which the research has shown should be customer demand and 2) agreeing on the short-term forecast. This single plan will align the objectives and incentives for all three parties. A further revelation from the interview process was that the information considered to be key drivers of demand variability is available in some form between the three members and there was no discernible barrier to share the information. If this is the case, information sharing can only contribute positively to the supply chain reducing uncertainty and ultimately tame the BWE (Du et al., 2017, Wang and Disney, 2016, Dai et al., 2016, Yu et al., 2001).

4.2.3. Quantification of benefits

Analysing the actual inbound data for the 2017 period revealed that Lancewood had lost sales of R 71 734 008 caused by an inability to supply the inbound demand, which resulted in a 55.71% inbound service level into ICL. The inbound service levels could not be simulated given the shortage of raw material, therefore the production of the 900-gram Gouda cheese could not occur. It can be said that had the promotional information been communicated timeously, Lancewood could have acted to redirect raw materials to the production of the Gouda cheese, or look for alternate means to source the raw material. The decision would require the consideration of senior management because given the product shortage, PnP could have decided to have a competing product on promotion instead i.e. Clover. which could have resulted in Lancewood losing market share. The analysis assumed that PnP did not source from other manufacturers, even though in practice this might not have happened.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

This study illustrated the existence of the BWE and the range of benefits to the members in the supply chain that can be brought about by information sharing. From a financial point of view, a reduction in lost sales, less product write-offs and less over stock charges will assist the bottom line. Operationally, the changes will bring about supply chain efficiency by having optimised warehouses, correct timing and availability of stock and improved order fill rate which will contribute to improved revenue and service levels. The benefit for Lancewood is certainty in what they need to plan, meaning an optimised factory.

A key benefit of the study is enhanced awareness of the issues related to the BWE by all members of the supply chain and avoid the negative effects of the BWE. As a result of this it should be possible to better coordinate activities to bring about supply chain efficiencies.

Further research can be conducted by putting into practice the suggested information sharing that was discussed in the report. Facilitating and aligning the flow of information between Lancewood, ICL and PnP by fostering strategic alliances and measuring the benefits of such interventions. The impact of these changes could be measured and reported.

While the research focused a single retailer and manufacturer, the same approach can be used to analyse the benefits of information sharing to current and future manufacturers serviced by ICL and other logistics companies in South Africa.

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**APPENDIX A - QUANTIFICATION OF LOST SALES FOR LANCEWOOD USING
ACTUAL INBOUND ORDER QUANTITY AGAINST DELIVERED QUANTITY**

Weeks	Inbound Sales with no information sharing		
	<u>Total Order Quantity</u>	<u>Total Delivered Quantity</u>	<u>Lost Sales</u>
1	5 000	1 080 R	1 736 129
2	65	65 R	-
3	67	63 R	1 772
4	6 015	2 575 R	1 523 542
5	4 535	755 R	1 674 124
6	4 017	2 177 R	814 918
7	6 530	2 429 R	1 816 292
8	5 001	2 401 R	1 151 514
9	3 079	3 079 R	-
10	4 511	1 091 R	1 514 684
11	88	88 R	-
12	5 746	2 046 R	1 638 693
13	3 034	3 034 R	-
14	4 010	850 R	1 399 532
15	5 038	1 118 R	1 736 129
16	9 415	915 R	3 764 565
17	6 359	760 R	2 479 741
18	3 735	3 735 R	-
19	3 869	2 109 R	779 486
20	1 010	1 010 R	-
21	7 620	2 224 R	2 389 834
22	6 531	1 465 R	2 243 681
23	8 065	2 465 R	2 480 184
24	5 438	3 878 R	690 908
25	6 306	1 260 R	2 234 823
26	7 566	2 806 R	2 108 156
27	8 754	2 454 R	2 790 207
28	5 115	1 215 R	1 727 271
29	6 092	2 292 R	1 682 982
30	5 508	2 408 R	1 372 959
31	3 741	2 521 R	540 326
32	4 121	2 401 R	761 771
33	8 521	1 148 R	3 265 428
34	9 635	2 882 R	2 990 836
35	11 944	3 064 R	3 932 863
36	10 410	910 R	4 207 455
37	9 061	1 141 R	3 507 689
38	9 319	2 019 R	3 233 097
39	3 640	3 640 R	-
40	10 010	2 530 R	3 312 817
41	10 286	5 396 R	2 165 732
42	8 692	4 792 R	1 727 271
43	5 727	5 727 R	-
44	14	14 R	-
45	3 990	4 070 -R	35 431
46	6 382	5 542 R	372 028
47	6 147	6 147 R	-
48	4 118	4 118 R	-
49	2 948	2 948 R	-
50	13	13 R	-
51	758	758 R	-
52	2 529	2 529 R	-
	280 125	118 157 R	71 734 008

**APPENDIX B - QUANTIFICATION OF LOST SALES FOR ICL USING ACTUAL AND
SIMULATED OUTBOUND DELIVERED QUANTITIES**

Weeks	Outbound Sales with no information sharing				Outbound Sales with information sharing			
	<u>Total Order Quantity</u>	<u>Delivered Order Quantity</u>		<u>Lost Sales</u>	<u>Total Order Quantity</u>	<u>Delivered Order Quantity</u>		<u>Lost Sales</u>
1	344	300	R	20 842	344	300	R	20 842
2	692	692	R	-	692	692	R	-
3	425	224	R	95 210	425	400	R	11 842
4	821	77	R	352 418	821	800	R	9 947
5	1 030	741	R	136 894	1 030	1 030	R	-
6	800	271	R	250 577	800	800	R	-
7	704	533	R	80 999	704	650	R	25 579
8	987	699	R	136 420	987	900	R	41 210
9	695	695	R	-	695	695	R	-
10	399	399	R	-	399	399	R	-
11	271	271	R	-	271	271	R	-
12	687	57	R	298 418	687	630	R	27 000
13	1 055	665	R	184 735	1 055	1 055	R	-
14	591	100	R	232 577	591	520	R	33 631
15	728	243	R	229 735	728	660	R	32 210
16	1 012	451	R	265 734	1 012	1 012	R	-
17	2 171	1 301	R	412 102	2 171	2 171	R	-
18	2 044	1	R	967 728	2 044	1 714	R	156 314
19	1 321	1 257	R	30 316	1 321	1 300	R	9 947
20	927	911	R	7 579	927	927	R	-
21	1 662	1 271	R	185 209	1 662	1 662	R	-
22	2 286	1 615	R	317 839	2 286	2 229	R	27 000
23	781	615	R	78 631	781	710	R	33 631
24	476	370	R	50 210	476	476	R	-
25	577	577	R	-	577	577	R	-
26	464	464	R	-	464	464	R	-
27	493	474	R	9 000	493	474	R	9 000
28	410	410	R	-	410	410	R	-
29	839	839	R	-	839	839	R	-
30	1 880	1 880	R	-	1 880	1 880	R	-
31	1 880	1 880	R	-	1 880	1 880	R	-
32	331	331	R	-	331	331	R	-
33	357	357	R	-	357	357	R	-
34	491	491	R	-	491	491	R	-
35	607	607	R	-	607	607	R	-
36	244	244	R	-	244	244	R	-
37	422	422	R	-	422	422	R	-
38	1 191	912	R	132 157	1 191	1 090	R	47 842
39	2 589	1 560	R	487 417	2 589	2 450	R	65 842
40	3 106	1 990	R	528 627	3 106	2 784	R	152 525
41	646	646	R	-	646	646	R	-
42	575	575	R	-	575	575	R	-
43	1 792	1 792	R	-	1 792	1 792	R	-
44	1 889	1 889	R	-	1 889	1 889	R	-
45	2 969	2 607	R	171 472	2 969	2 969	R	-
46	1 618	1 618	R	-	1 618	1 618	R	-
47	2 145	1 678	R	221 209	2 145	1 678	R	221 209
48	2 856	2 856	R	-	2 856	2 856	R	-
49	2 161	2 161	R	-	2 161	2 161	R	-
50	1 628	1 628	R	-	1 628	1 628	R	-
51	1 871	1 871	R	-	1 871	1 871	R	-
52	1 008	760	R	117 473	1 008	760	R	117 473
	59 948	47 278	R	6 001 526	59 948	57 746	R	1 043 043
					Benefit			R 4 958 482

**APPENDIX C - QUANTIFICATION OF LOST SALES FOR LANCEWOOD USING
ACTUAL AND SIMULATED OUTBOUND DELIVERED QUANTITIES**

Weeks	Outbound Sales with no information sharing				Outbound Sales with information sharing			
	<u>Total</u>	<u>Delivered</u>		<u>Lost Sales</u>	<u>Total</u>	<u>Delivered</u>		<u>Lost Sales</u>
	<u>Order</u> <u>Quantity</u>	<u>Order</u> <u>Quantity</u>			<u>Order</u> <u>Quantity</u>	<u>Order</u> <u>Quantity</u>		
1	344	300	R	19 487	344	300	R	19 487
2	692	692	R	-	692	692	R	-
3	425	224	R	89 021	425	400	R	11 072
4	821	77	R	329 510	821	800	R	9 301
5	1 030	741	R	127 995	1 030	1 030	R	-
6	800	271	R	234 289	800	800	R	-
7	704	533	R	75 734	704	650	R	23 916
8	987	699	R	127 552	987	900	R	38 531
9	695	695	R	-	695	695	R	-
10	399	399	R	-	399	399	R	-
11	271	271	R	-	271	271	R	-
12	687	57	R	279 021	687	630	R	25 245
13	1 055	665	R	172 727	1 055	1 055	R	-
14	591	100	R	217 459	591	520	R	31 445
15	728	243	R	214 802	728	660	R	30 117
16	1 012	451	R	248 461	1 012	1 012	R	-
17	2 171	1 301	R	385 314	2 171	2 171	R	-
18	2 044	1	R	904 824	2 044	1 714	R	146 154
19	1 321	1 257	R	28 345	1 321	1 300	R	9 301
20	927	911	R	7 086	927	927	R	-
21	1 662	1 271	R	173 170	1 662	1 662	R	-
22	2 286	1 615	R	297 179	2 286	2 229	R	25 245
23	781	615	R	73 520	781	710	R	31 445
24	476	370	R	46 946	476	476	R	-
25	577	577	R	-	577	577	R	-
26	464	464	R	-	464	464	R	-
27	493	474	R	8 415	493	474	R	8 415
28	410	410	R	-	410	410	R	-
29	839	839	R	-	839	839	R	-
30	1 880	1 880	R	-	1 880	1 880	R	-
31	1 880	1 880	R	-	1 880	1 880	R	-
32	331	331	R	-	331	331	R	-
33	357	357	R	-	357	357	R	-
34	491	491	R	-	491	491	R	-
35	607	607	R	-	607	607	R	-
36	244	244	R	-	244	244	R	-
37	422	422	R	-	422	422	R	-
38	1 191	912	R	123 566	1 191	1 090	R	44 732
39	2 589	1 560	R	455 734	2 589	2 450	R	61 562
40	3 106	1 990	R	494 265	3 106	2 784	R	142 611
41	646	646	R	-	646	646	R	-
42	575	575	R	-	575	575	R	-
43	1 792	1 792	R	-	1 792	1 792	R	-
44	1 889	1 889	R	-	1 889	1 889	R	-
45	2 969	2 607	R	160 326	2 969	2 969	R	-
46	1 618	1 618	R	-	1 618	1 618	R	-
47	2 145	1 678	R	206 830	2 145	1 678	R	206 830
48	2 856	2 856	R	-	2 856	2 856	R	-
49	2 161	2 161	R	-	2 161	2 161	R	-
50	1 628	1 628	R	-	1 628	1 628	R	-
51	1 871	1 871	R	-	1 871	1 871	R	-
52	1 008	760	R	109 837	1 008	760	R	109 837
	59 948	47 278	R	5 611 416	59 948	57 746	R	975 244
					Benefit			R 4 636 173

APPENDIX D - AVERAGE INVENTORY CARRYING COSTS

<u>Week</u>	<u>Average Weekly Inventory Balance</u>		<u>Average Inventory Carrying Costs</u>
1	6 206	R	2 748 575
2	3 649	R	1 616 106
3	614	R	271 934
4	1 180	R	522 610
5	1 144	R	506 666
6	873	R	386 643
7	689	R	305 151
8	2 316	R	1 025 733
9	2 755	R	1 220 162
10	3 476	R	1 539 486
11	3 079	R	1 363 658
12	1 237	R	547 855
13	1 713	R	758 671
14	474	R	209 930
15	868	R	384 429
16	465	R	205 944
17	574	R	254 219
18	1 555	R	688 694
19	1 471	R	651 491
20	1 076	R	476 550
21	1 304	R	577 529
22	972	R	430 489
23	1 630	R	721 911
24	2 897	R	1 283 052
25	3 604	R	1 596 176
26	2 788	R	1 234 777
27	2 826	R	1 251 607
28	2 223	R	984 544
29	2 669	R	1 182 073
30	2 405	R	1 065 150
31	2 082	R	922 097
32	3 582	R	1 586 432
33	4 960	R	2 196 734
34	4 332	R	1 918 599
35	3 328	R	1 473 938
36	2 916	R	1 291 467
37	2 343	R	1 037 691
38	1 287	R	569 999
39	1 139	R	504 452
40	1 496	R	662 563
41	1 623	R	718 810
42	5 245	R	2 322 958
43	8 036	R	3 559 064
44	6 250	R	2 768 063
45	5 500	R	2 435 895
46	5 394	R	2 388 949
47	7 169	R	3 175 078
48	10 319	R	4 570 182
49	10 155	R	4 497 548
50	8 776	R	3 886 803
51	5 976	R	2 646 711
52	5 488	R	2 430 580
Average	3 195	R	1 414 931

APPENDIX E - QUANTIFICATION OF ICL'S LOST COMMISSION

Weeks	ICL Lost Commission	
	With no information sharing	With information sharing
1	R 1 355	R 1 355
2	R -	R -
3	R 6 189	R 770
4	R 22 908	R 647
5	R 8 898	R -
6	R 16 288	R -
7	R 5 265	R 1 663
8	R 8 868	R 2 679
9	R -	R -
10	R -	R -
11	R -	R -
12	R 19 398	R 1 755
13	R 12 008	R -
14	R 15 118	R 2 186
15	R 14 933	R 2 094
16	R 17 273	R -
17	R 26 787	R -
18	R 62 904	R 10 161
19	R 1 971	R 647
20	R 493	R -
21	R 12 039	R -
22	R 20 660	R 1 755
23	R 5 111	R 2 186
24	R 3 264	R -
25	R -	R -
26	R -	R -
27	R 585	R 585
28	R -	R -
29	R -	R -
30	R -	R -
31	R -	R -
32	R -	R -
33	R -	R -
34	R -	R -
35	R -	R -
36	R -	R -
37	R -	R -
38	R 8 590	R 3 110
39	R 31 683	R 4 280
40	R 34 362	R 9 914
41	R -	R -
42	R -	R -
43	R -	R -
44	R -	R -
45	R 11 146	R -
46	R -	R -
47	R 14 379	R 14 379
48	R -	R -
49	R -	R -
50	R -	R -
51	R -	R -
52	R 7 636	R 7 636
	R 390 109	R 67 800
Benefit		R 322 310

APPENDIX F - KEY DRIVERS OF DEMAND VARIABILITY

Lancewood	ICL	PnP
Promotions	Promotions	Promotions (Type e.g. Bonus buy)
Seasonality	Seasonality	Seasonality and time of month
Raw material shortages	Pricing	Pricing
Competitors out of stock	Competitors out of stock	Stock Availability
Forecast accuracy	Forecast accuracy	Forecast accuracy
	Poor Communication	Quality
	Supply Issues	Brands
	Display of products	Marketing
		Distribution channel structure
		Display of products

APPENDIX G – ICL QUESTIONNAIRE

Title of the study: Questionnaire on Managing Supply Chain Demand Variability
Through Information Sharing

Student: Amanda Subiah
ID Number: 8112070177089
Student Number: 1246946

Supervisor(s): Andres Merino and Katinka Vermeulen
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Masters of Commerce Supervisors on behalf of the University of the Witwatersrand

Introduction

The supply chain of ICL is currently struggling with the classic symptoms of a mismatch between supply and demand, low sales forecast accuracy, high and aging inventory, as well as low customer service. The importance of this study for ICL can lead to an improvement in the current misalignment between demand and supply between the respective parties (Lancewood, ICL and PnP). Alignment between demand and supply can lead to lower inventory levels, increased service levels, improved working capital management and high sales forecast accuracy

The aim of the research

The purpose of this study is to identify the key drivers of demand variability and to determine whether the misalignment within a supply chain between supply and demand can be reduced and the benefits quantified.

Questionnaire

- 1) Does the company have various forecast targets which a manufacturer or the retailer, for example, sales targets and financial targets, and which target is used to align supply and demand?
- 2) Do the current controls and procedures hinder or aid information sharing for the 3 parties and how?
- 3) What are the key drivers of demand variability in the supply chain and for the organisation specifically?
- 4) What changes to the procedures, information sharing and controls can be introduced to reduce demand variability?
- 5) What would be the benefits of aligning supply and demand for all 3 parties?
- 6) What are the costs and implications of the misalignment between supply and demand?

APPENDIX H – LANCEWOOD QUESTIONNAIRE

Title of the study: Questionnaire on Managing Supply Chain Demand Variability
Through Information Sharing

Student: Amanda Subiah
ID Number: 8112070177089
Student Number: 1246946

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Masters of Commerce Supervisors on behalf of the University of the Witwatersrand

Introduction

The supply chain of ICL is currently struggling with the classic symptoms of a mismatch between supply and demand, low sales forecast accuracy, high and aging inventory, as well as low customer service. The importance of this study for ICL can lead to an improvement in the current misalignment between demand and supply between the respective parties (Lancewood, ICL and PnP). Alignment between demand and supply can lead to lower inventory levels, increased service levels, improved working capital management and high sales forecast accuracy

The aim of the research

The purpose of this study is to identify the key drivers of demand variability and to determine whether the misalignment within a supply chain between supply and demand can be reduced and the benefits quantified.

Questionnaire

1) Which demand are you trying to forecast and why?

- 2) What other demand data sources are available? Are these actively used in the forecasting and demand planning process?
- 3) Does Lancewood use the forecast provided by PnP for production planning?
- 4) What is the trigger for the supply chain – order or forecast?
- 5) Does the company actively try to manage demand? E.g. when it knows that there may be a shortage or surplus of supply?
- 6) Which additional information, if obtained, could result in an increase in forecast accuracy and decrease in inventory?
- 7) What type of information should be shared between suppliers and retailers to align demand and supply and to reduce demand variability?
- 8) What are the key drivers of demand variability for Lancewood, for example, terms of trade, promotions and pricing, specific company policies, distribution channel structure, delays, and economies of scale?
- 9) What changes to the procedures, information sharing and controls can be introduced to reduce demand variability?

APPENDIX I – PICK N PAY QUESTIONNAIRE

Title of the study: Questionnaire on Managing Supply Chain Demand Variability
Through Information Sharing

Student: Amanda Subiah
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Student Number: 1246946

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Masters of Commerce Supervisors on behalf of the University of the Witwatersrand

Introduction

The supply chain of ICL is currently struggling with the classic symptoms of a mismatch between supply and demand, low sales forecast accuracy, high and aging inventory, as well as low customer service. The importance of this study for ICL can lead to an improvement in the current misalignment between demand and supply between the respective parties (Lancewood, ICL and PnP). Alignment between demand and supply can lead to lower inventory levels, increased service levels, improved working capital management and high sales forecast accuracy

The aim of the research

The purpose of this study is to identify the key drivers of demand variability and to determine whether the misalignment within a supply chain between supply and demand can be reduced and the benefits quantified.

Questionnaire

- 1) Which demand are you trying to forecast and why? (end consumer demand, or store demand per category and brand, or regional demand per category, etc.)
- 2) Which other demand data sources are available to PnP? Are these actively used in the forecasting and demand planning process? Examples could include:
 - Supplier forecasts.
 - Point-of-sales data.
 - Customer warehouse movement data
 - Customer order data
 - Store operations data (e.g. out of stocks, stock losses, write-off of expired stock, stock damages) actively used.
 - Information on the demand for a product whilst its direct competitor is on promotion.
 - Price elasticity of demand per product Promotional
- 3) What is the trigger for the supply chain – order or forecast?
- 4) Does Pick n Pay actively try to manage demand? E.g. when it knows that there may be a shortage or surplus of supply?
- 5) To what extent does Pick n Pay involve customers and suppliers in the planning and execution activities within your supply chain?
- 6) What are the causes of demand variability, for example, terms of trade, promotions and pricing, specific company policies, distribution channel structure, delays, and economies of scale?
- 7) Which additional information, if obtained, could result in an increase in forecast accuracy and decrease in inventory?
- 8) What are the types of costs and the possible implications of misalignment between supply and demand? What would the impact be on inventory carrying costs,

markdown costs and stock out costs, versus target and have the costs increased or decreased over the past year?

- 9) What type of information should be shared between suppliers and retailers to align demand and supply and to reduce demand variability?
- 10) Do the current controls and procedures between the supplier and the retailer hinder or promote information sharing between the parties?
- 11) Would the retailer be able to share its medium term (4 to 8 weeks) forecast with the supplier to align it with the production planning process?