

TITLE PAGE

UNIVERSITY OF KWAZULU-NATAL

Logistics Efficiency in the South African Chemical Distribution Sector

By

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**A dissertation submitted in partial fulfilment of the requirements for the
degree of**

Master of Business Administration

Graduate School of Business and Leadership

College of Management Studies

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Year of submission: 2012

DECLARATION

I Karen Valery Bayley declare that:

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Acknowledgements

I wish to express my sincere appreciation and gratitude to the following individuals, without whose assistance, this study would not have been possible:

- My husband John, who has supported and encouraged me throughout the MBA process, making sure that I had a constant supply of meals and refreshments to keep me going through the long hours of work.
- My employers who have sponsored my studies and encouraged me to take this course for my career advancement; then given me the opportunity to grow and use my skills by promoting me into strategic management.
- My daughter Virginia-Lee, who has proof read this document and checked my referencing and layouts.
- My supervisor, Danny McCabe, who has shown exceptional patience, wisdom and understanding while guiding me through the completion of this study.
- My colleagues and associates, and members of the sector who assisted me in the administration of the questionnaires.
- Finally, the respondents from the chemical distribution sector who completed the interview schedule and questionnaire and added immense value to the outcome of the research.

ABSTRACT

The chemical raw material distribution sector in South Africa is a very competitive market segment, moving mainly commodity raw materials between their manufacturers and the finished goods manufacturers. With ever more knowledgeable customers demanding service excellence and inventory availability, with short lead times, the distributors need to leverage their logistics efficiencies to set themselves apart by offering unique additional value to their customers. This also improves margins, providing a sustainable competitive edge. The objective of the study was to identify best practices and technology tools to improve logistics efficiencies, information systems to enable these best practices and human resource and training aspects that need to be considered within the South African context. After an initial explorative literature review, the data that was analysed through descriptive and inferential statistics, in support of the objectives, was derived from a phenomenological interview schedule completed by 33 subjects and a structured questionnaire completed by 121 subjects, comprising of elements from suppliers, distributors and customers. The literature review revealed a number of business operations and logistics management concepts and best practice management tools useful for logistics improvements. The need for good information and communication was highlighted, along with the need for appropriately designed, networked business supply chains that meet the customers' buying behaviours. Furthermore a number of technological tools and information systems to enable the best practices were revealed. It was found that correctly identified core capabilities necessary for success assist in identifying core competencies and skills needed. A number of skills development methods were identified. From research data collected, the constraints and needs discussed and recommendations received, it was confirmed that a number of the best practices, technology tools, information systems, human resource strategies and skills development techniques identified in the literature review and the data are applicable in the chemical raw material distribution sector in South Africa. It is recommended that distributors invest in technology and information systems, focus on supply chain design, demand forecasting, advanced shipping notices, effective management tools and invest in skills development to improve logistics efficiency.

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CHAPTER ONE

OVERVIEW

1.1 Introduction

The chemical raw materials distribution sector operates as a vital link for moving products between the global raw materials and finished goods manufacturers (Campbell, 2011). It distributes into diverse geographic areas, supplying customers a mixed 'basket of goods' in quantities that they need, when they need them, at the price they need (Eberhard, 2012). The South African sector, selling commodity and speciality chemicals nationally in a competitive market, is the largest in Africa, with the chemical manufacturing sector accounting for 25% of manufacturing volumes and 5% of GDP in 2008 (Van Zyl, 2008). Due to competitive and economic pressures both the raw material manufacturers and customers try to hold minimum inventory and have easy access to inventory availability, with short delivery lead times. The predominantly commodity products are sold in high volumes at competitive prices and are subject to exchange rate and world supply and demand volatility (Van Zyl, 2008; Kannegiesser, Günther, Beek, Grunow, and Habla, 2009). The internet and electronic media have created customers who are increasingly more knowledgeable and demanding of high levels of customer service (Hayes, 2004). It is difficult for distributors to set themselves apart without leveraging their logistics operations to achieve customer service excellence and low cost for competitive advantage (Eberhard, 2012).

Chapter one sets out an overview of the study, the problem statement is presented and the motivation for the study is given. The focus of the study will be explained before the research questions and objectives are listed. The proposed research methodology will be discussed before a short outline of each of the remaining four chapters is given

1.2 Problem statement

Chemical raw material distributors compete for growth in sales volumes and profitability. With suppliers and customers both striving towards holding leaner

inventory and running lean operations, with stock available on short notice, the pressure to hold stock and run efficient operations is pushed onto the intermediate distributor (Fermont, 2009; Rushton, Croucher and Baker, 2010; Campbell, 2011). In a commodity product sector logistics efficiency improvements allow a distributor to add value to its customers and differentiate itself from its competitors on good service delivery, to reduce cost of operations, improve its margins and end price to its customers, improving profitability and competitiveness (Mentzer and Williams, 2001; Bowersox, 2008). Distributors need to identify best practices to improve their logistics efficiencies and meet their customers' needs. Holding high volumes of inventory will tie up working capital and impact negatively on efficient logistics operations and costs. Distributors need to find ways to streamline supply and demand to reduce inventory levels and need for working capital (De Villiers, Nieman and Niemann, 2010). Poirier (2005) noted that the flow of information within a business network is critical to coordination and the physical movement of goods and services. Technology tools and information systems are used to good effect to implement best practice logistics improvements and inventory management systems (Buxton and Jutras, 2006; De Villiers, Nieman and Niemann, 2010). Suitable technology and information systems are important to distributors. However, competitive advantage relies not only on infrastructure and best practice, but on skilled people and good human relations to implement and achieve the organisations competitive objectives, but skills shortages are repeatedly reported as a constraint in logistics (Barloworld Logistics, 2012).

The majority of the literature available for review related to the chemical industry in Canada, America, the United Kingdom, the East and Australasia. Very little material could be found relating to the chemical industry that could clarify the applicability and acceptability of the identified best practices and technology concepts to the South African chemical distribution sector. The material relating to logistics, training and skills development was more focused to the third party logistics industry. The overall aim of the study is to research and investigate if there are best practices, technologies and human resource strategies available to improve logistics efficiencies for optimal customer service in this sector.

1.3 Motivation for the study

Chemical distribution organisations will benefit from this study, as they can gain valuable information that can assist them to improve their logistics efficiencies, resulting in sales volume growth, cost reductions, profits and reputation. The customers of the distributors who require fast and efficient service will benefit from improved efficiency in their logistics operations. This will bring them closer to their ideal of just in time inventory replenishment, with reliable service delivery and make the distributor an important partner in their supply chain. Employees will benefit from the necessary business operations considerations, the correct training and development and implementation of best practices to perform streamlined tasks efficiently, gaining more job satisfaction. Managers will benefit from being armed with information and guidelines on the relevant technology and practices, and from achieving a more efficient operation, appreciation from shareholders and good reputation. The shareholders of distributors will benefit through improved dividends from growth in profits and security in the sustainability of the organisation. The unique contribution that this study will bring to business operations, supply chain, logistics and distribution disciplines in South Africa will be an understanding of the applicability and acceptability of the identified best practices, logistics, human resource management concepts and skills development methods to the chemical raw material distribution sector for logistics efficiency improvements. The study will further endeavour to find additional best practices, technologies, human resource aspects and skills development methods that will add to the body of knowledge and add value to the sector.

1.4 Focus of the study

This study will focus on the improvement of efficiencies in logistics operations in the chemical distribution sector in South Africa, with an emphasis on identifying best practices, technology tools and information systems to support the best practices, and the skills development and human resource aspects to be considered to achieve efficient logistics.

1.5 Research questions

1. Can logistics best practices be identified that will improve chemical distributors' logistics operation efficiency and customer service?

2. What information systems and technologies will assist in best practice logistics efficiency?
3. What human resource and physical aspects need to be considered to implement further logistics best practices and technologies for optimal customer service?

1.6 Objectives

1. Determine if logistics best practices and technologies can be identified which will improve logistics efficiency for improved customer service in the chemical distribution sector.
2. Determine what information system technologies may enable best practice logistics and improve efficiency of logistics operations in the South African chemical distribution sector.
3. Determine what Human Resource and training aspects must be considered

1.7 Proposed methodology

The research will start with the initial collection of data through qualitative methods of research, such as a literature review of previously published works, and exploratory studies in order to understand the nature of the problem (Sekaran and Bougie 2010). This will include the use of an interview survey to garner open-ended, rich information from purposively selected subjects (Lee and Lings, 2008). This will be followed by the collection of quantitative data done via the administering of a well-structured and logical questionnaire. The data collected and recorded from the questionnaire will be analysed and evaluated statistically, to make an estimate or decision about the population parameters and profile based on inferences and descriptive analysis from the sample data statistics (Wood, 2000; Sekaran and Bougie, 2010).

The location will be national at each of a distribution company's branches, for consistency and completeness. The study will include interviews (phenomenological discussions) with employees in different roles and regions, to gather suggestions of possible best practice implementations. Data will also be collected from customers on their needs and what technologies and human resource aspects are pertinent to efficient logistics. Suppliers will be included in

the sample for understanding of logistics best practices they use for good affect. Data from these sources will be analysed and tested, ensuring that only clean data is used and doubtful or 'dirty' data (incorrectly answered questions or inconsistencies in responses to questions) is excluded, to compare an observed distribution with an expected distribution (Lind, Marchal & Wathen 2010). The occurrence of 'dirty' amongst clean data recorded causes incorrect or skew results (Sekaran and Bougie 2010).

1.8 Chapter outline

Chapter 1: provides an overview of the study and how it will be conducted. It explains the problem statement, defines the research questions and objectives, the benefits, focus and motivation of the study. The proposed research methodology is also explained.

Chapter 2: is a literature review which provides a theoretical foundation and background for the study. It will explore the background of the chemical raw material distribution sector, concepts of business operations, networking, supply chain, and logistics operations. It will look at the importance of logistics to customer service and try to identify information systems that may enable logistics efficiency. After investigating the relevance of best practices it will contemplate the human resource aspects and skills development methods available to strengthen core competencies for logistics efficiency.

Chapter 3: explains and justifies the proposed research methodology to collect and analyse data from the sample population, enabling the researcher to make inferences regarding the profile of the chemical distribution sector.

Chapter 4 (4 & 5 combined): uses inferential and descriptive statistics to present and discuss the data collected and analysed from the qualitative and quantitative data, describing identified trends, correlations and incongruences to understand the acceptance and applicability of the best practices, technologies, human resource aspects and skills development methods identified to improve logistics efficiencies. This chapter also interprets and explains the findings in conjunction with readings, case studies and company reports

Chapter 5 (6): presents the recommendations for implementation of best practice business strategies, operations, supply chain concepts, warehouse and transport concepts and tools. It makes recommendations relating to technology and information systems identified as applicable to the sector. The chapter concludes with recommendations relating to core capabilities, skills requirements, HR strategies and skills development methods that will strengthen implementation of best practices and technologies.

1.9 Conclusion

This chapter has provided an overview of the field of study. It has discussed the problem statement, motivation and focus of the study. The research questions and objectives of the study were listed. Thereafter a short description of the proposed research methodology was given. Finally a brief overview of the content of each chapter was presented. Chapter two will provide a review of the literature to understand the factors affecting the chemical raw material distribution sector and identify possible best practices, technologies, information systems, HR and skills development solutions to answer the research questions.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter looks at relevant literature related to efficiency improvements in operations, logistics and improvement of customer service. It begins with a background of the chemical industry, defines and expounds upon the concepts and management of business operations, logistics and customer service, identifies the information technologies that may enable efficiency improvements, discusses the concept of best practices and specific best practices identified in the area of warehouse and delivery systems, and is concluded with a review on the human resources aspects and the skills required for efficient logistics, with reference to the South African environment.

2.2 Chemical industry and distribution sector background

The chemical raw material distribution sector is a vital link for moving products between the global raw materials producers and finished goods manufacturers (Campbell, 2011). The South African manufacturing sector, the largest in Africa, produces a wide range of products for end uses including personal care, household cleaning, food, water treatment, and adhesives, amongst others, from commodity and speciality chemicals. This sector operates in a competitive market, with volatile prices and availability of raw materials (Van Zyl, 2008). The volatility is caused by fluctuating scarcity and oversupply, affected by fluctuations in exchange rates, international supply and demand and long lead times on imports (Kannegiesser, Günther, Beek, Grunow, and Habla, 2009). The on-going recession, which began in 2008 has resulted in manufacturers of raw materials and finished goods seeking lean manufacturing operations and moving to just in time inventory replenishment. The pressure for holding inventory and running efficient, flexible warehouse and distribution systems has therefore been forced onto the intermediate distributors (Fermont, 2009; Rushton, Croucher and Baker, 2010; Campbell, 2011). As companies increasingly adopt 'just in time' strategies, and hold minimum inventories they demand shorter lead times and more reliable deliveries. Companies therefore need to progressively improve levels of supplier

response, while also seeking to downsize their supplier base to streamline their supply line, putting further pressure on suppliers (Christopher, 2011).

According to Baker (2011, p.37) there is a market shift driving chemical producers to a greater dependence on distributors. “Leading chemical producers are increasing their use of distribution partners to service customers cost-effectively and to achieve faster growth in the marketplace”. Eisberg (2010) however, noted that chemical distribution “is more than selling”. Although the volumes distributed may be high the margins are small, and as small scale operators have grown and tended to specialise in specific product and industry sectors, or consolidate into large organisations to provide a basket of goods, larger distributors are finding it difficult to be agile and responsive to customer needs. The nimbler distributor/trader with personal relationships and understanding of market needs is more effective and successful. Baker (2011, p.38) further reported that chemical producers want distributors to, “accelerate the penetration of their products into the market” by handling the sales, marketing and logistics, while producers attempt to reduce the number of distributors in their supply chain with strategic distributor relationships. Customers benefit by access to worldwide sourcing and logistics with the resultant effect of a variety of products quickly available through local distributors (Baker, 2011; Engel and Roofsb-Broihan, 2006).

The raw materials distributor effectively reduces the storage, marketing and distribution burden and broadens the distribution channels of the raw material manufacturer, the supplier, while also reducing the raw material holding costs and financial risks of the finished goods manufacturer, who is their customer. This calls for effective business operations and identification of logistics best practices and technology, required to underpin strategies such as just in time, and the resources and skills in order to meet the customers’ demands (Engel and Roofsb-Broihan, 2006; Baker, 2011; Eberhard, 2011).

2.3 Concepts surrounding operations, logistics and logistics management

In order to discuss the improvement of logistics operation efficiency it is necessary to lay the foundations by understanding the definition of business operations and logistics, and the management of these aspects of the business.

2.3.1 The business, operations and management concepts

Gattorna (2003) explained business operations by expounding on the “Performance Pyramid”, shown in Figure 2.1 and initially developed by Judson (1991).

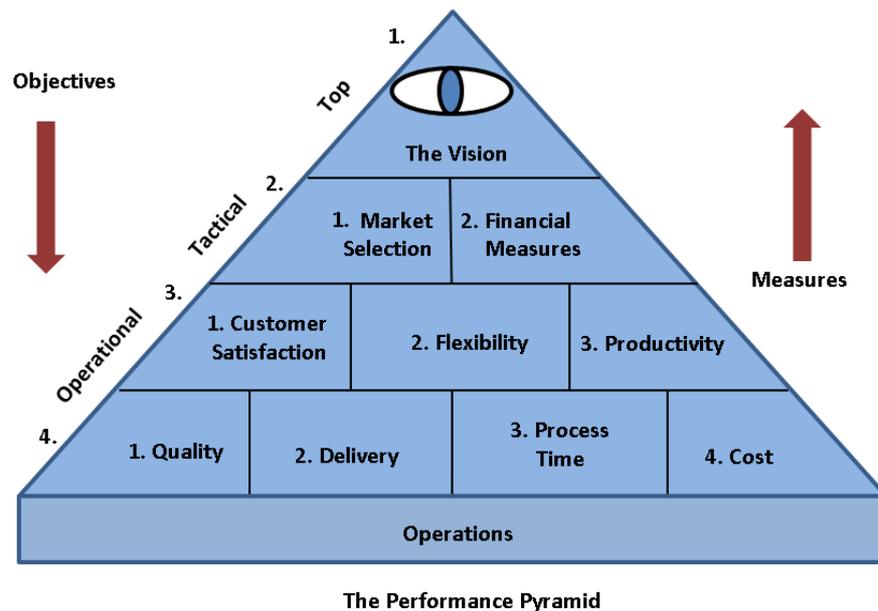


Figure 2.1 The performance pyramid

Source: Adapted from Judson, 1991, cited in Gattorna, 2003, p254.

In figure 2.1 the top level of the pyramid, the corporate level of the business, determines the overall vision of the company that defines the strategies. The second level defines how the strategies feed into the business unit short and long term market share, growth and profitability goals and objectives which are translated in the third level into the measurable objectives for achievement through the business operating system. The third level is where the control and measurement of departments start and the operating system represents necessary policies and procedures, activities and systems required to implement and achieve the objectives defined by the business units. Requirements of:

- 1) customer satisfaction – managing customer expectations,
- 2) flexibility – responsiveness of the system, and
- 3) productivity – management of time and resources,

define the business operating system objectives, which are further drilled down to specific measures. In the fourth level the major criteria for performance are:

- 1) quality – meeting targets for customer needs,

- 2) delivery of products and services to the customer on time,
- 3) process time – time from receipt of request to completion of the operation and
- 4) cost – the resources used to meet the delivery and the quality requirements of the customer.

These components need to be understood, both from the perspective of how they interact and how they behave. This is so that inter-dependencies, as discussed later in the value chain and total logistics concepts, can be recognised, and required adjustments for shared objectives can be communicated and managed to keep up with changes in the business. The operating objectives define the desired state 'to be'. The supporting measures of the operations are represented in the fifth level, where specific measures for successful flow-through between departments involved in ultimate delivery to the customer are determined. These measures assist the departments in focusing on how each one performs to impact the overall efficiency and effectiveness of the whole operating system without causing sub-optimisation - streamlining in one area which causes inefficiencies and expense in other areas of the system (Gattorna, 2003; Luo, Xu, and Li, 2005; Rushton, Croucher and Baker, 2010).

According to Porter (1985) the interaction of the different, discrete activities grouped into the departments of a firm are represented in its value chain (Figure 2.2). The company's value chain is defined by its strategy, the economics of each activity and how they are performed. Value is the total revenue from volumes sold and prices customers are prepared to pay for what the company produces (product plus value added). The margin is the difference between the value added to the customer and the total cost of providing it (Porter, 1985).

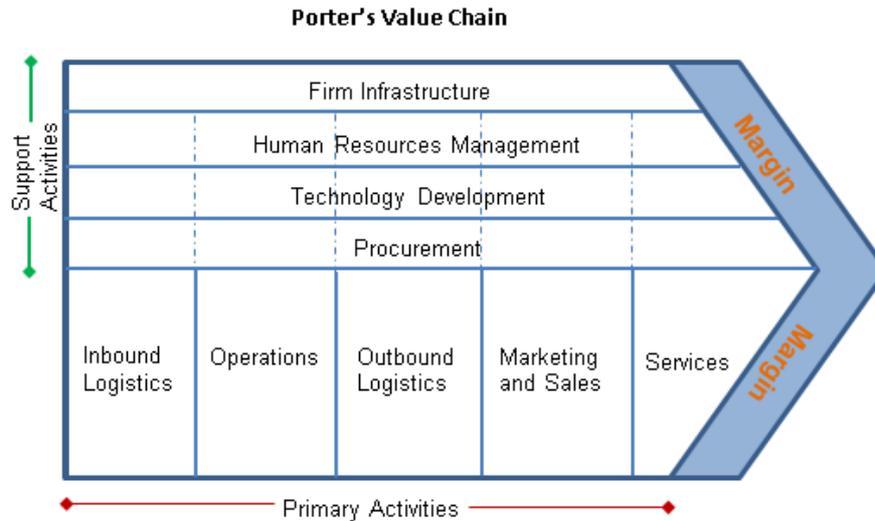


Figure 2.2 The generic value chain
Source: Adapted from Porter, 1985, p37.

The generic value chain in figure 2.2 categorises the value adding activities into 5 “primary activities - inbound logistics, operations, outbound logistics, marketing and sales, and service, and 4 secondary (support) activities – procurement, technology development, human resource management and company infrastructure”. The dotted lines into the support activities represent their relationship and importance to the primary activities by supplying infrastructure and inputs needed by them. Value and cost drivers are identified for each value activity. The costs of the activities are measured by the cost of all inputs used to complete them. Each activity can be a source of differentiation from competitors and extra value to the customer, establishing competitive advantage for the company. This is a powerful tool when used to analyse the contributions of activities to the overall level of customer value produced and ultimate financial performance. Understanding the linkages, cost and value adding capacity of the various activities is useful for strategic planning and will affect the structure of the company and value chains of its business units. The critical goal of the value chain as a whole is to maximise its value creations while minimising total cost for sustainable competitive advantage (Porter, M.E., 1985; De Villiers, Nieman and Niemann, 2010). Rainbird (2004) suggested that the company’s operations management is the architect and designer of its business model – what the company does, its systems and processes and how the constituent parts fit

together. The value chain provides an effective framework for this architecture, a way of dissecting, analysing then evaluating the business model and reengineering the processes underlying it. The analogy is valuable to the degree that it identifies internal processes that should be interlinked. Identifying the chain's "strong" and "weak" links is useful in identifying and defining a company's weaknesses or competitive advantages (Rainbird, 2004).

The chemical distributors have a challenging role in offering a value chain between the chemical producers and the processing industries who manufacture the finished goods as illustrated in figure 2.3 (Eberhard, 2012).

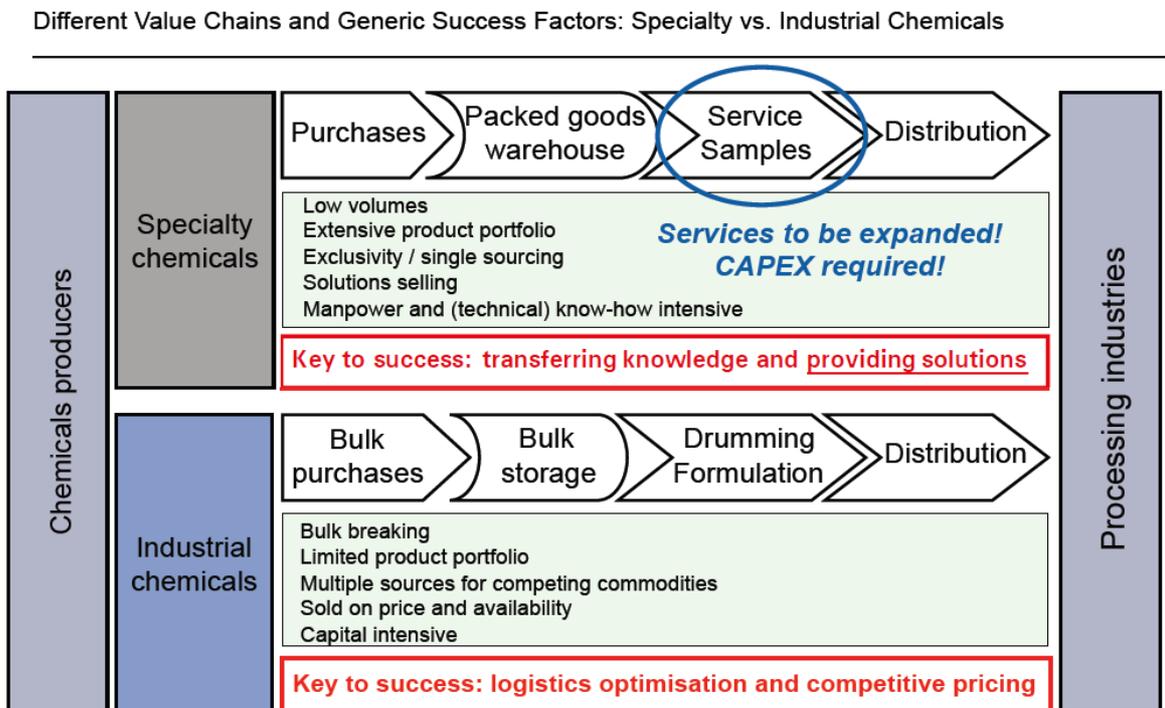


Figure 2.3 The value chain for the chemical industry.
Source: Eberhard, 2012, p.9. Used with permission from DistriConsult GmbH, 2012

In Figure 2.3 the value chain is broken down into 2 chains, Speciality and Industrial. The distributors require specific key elements, resources, infrastructure and technical knowledge in their value chain for distributing the lower volume speciality chemicals. This differs from what is required in the value chain for distribution of higher volume industrial chemicals, which tend to be more commodity chemicals. The key to success in the speciality chemical distribution

segment is knowledge transference and providing customers with solutions, while the more competitive, price driven industrial chemical segment is far more dependent on optimal logistics and low cost for competitive advantage (Eberhard, 2012). A processing customer may use a combination of speciality and industrial chemicals in their finished product. This adds complexity to the setting of a chemical distributor's strategies and objectives and to the value chain design. It makes the balance between operations, costs and customer-value-add more of an imperative for customer satisfaction and sustainable profitability (Engel and Roofls-Broihan, 2006; Baker, 2011; Eberhard, 2012).

This emphasises the importance of the operations and operations management component of the company. The Ferrara Consulting Group (FCG) (2006) defined operations as responsibilities and roles of operating groups working together towards an integrated business plan. Management participates in planning, developing opportunities and strategies, managing risk and resource allocation in a cycle of activities, with effective inter-departmental communication that builds consensus. This is all done within the guidelines of an integrated global budget and adherence to financial and operational best practices, controls, policies and procedures. Operations management focuses on ensuring a departmental budget process that aggregates to a "cohesive strategic plan" and effective management of execution at tactical level; plus bridging vision and strategy with readiness at operational level. They further ensure balance between groups for ultimate performance, implementation of standards and performance metrics, and compliance to best practice via re-engineering and auditing of processes departmentally and globally to ensure productivity. This includes human resource management, succession planning, mentoring and coaching, provision of guidance, direction, and training for all levels. The overall cost management to achieve financial objectives, as well as oversight and management of third party relationships, including reviewing of contracts and due diligence is also covered in operations management (FCG, 2006).

The significance of third party relationships was underlined by Rainbird (2004) and Hayes (2004) who asserted that the "New Economy" is seen in the evolution of the Internet and quick technology change, turbulent markets, uncertainty of demand

and increasing demand for better quality and service. This is changing market structures, with power shifting towards more informed buyers in competitive and saturated markets, shorter product life cycles and expanding distribution channel choices, driving the focus of operations management away from an individual company's value chain to the geographically expanded networks of inter-company operating relationships creating "virtual integration". This forces companies to assess and reengineer their core processes and capabilities to link their activities into the greater structure of networked business value chains, as customer retention through excellent, responsive service becomes ever more essential. The value chain is viewed at the industry framework level, network integration level and internal company level where operations management tailors internal processes to link with changes in the industry in which it operates. Management will design their business model to capitalise on the network links and optimise the company's position in the industry value chain through establishment of its resources, core processes and capabilities (Porter, 1985; Rainbird, 2004; Hayes, 2004). According to Lou, Xu and Li (2005) the operations strategy will look for the best external network fit for the company's environment and the best internal structural and process fit between elements and objectives, for a harmonised network whole that gives ultimate competitive advantage in the context of new information technology and the new networked economy, and regularly review the links for performance improvement.

Hayes (2008, p.571) further noted that as products and customer services become more entwined, companies increasingly offer bundles of these through networks with other companies. Coordinating these networks is possible via low-cost and powerful computer technology and communication. This is done "within the constraints established by the company's strategic goals, contractual and ethical obligations, relative power, skills, and resources". Operations managers need to understand how the network of multiple organisations as a whole behaves, how to design and manage teams across the network, the design and operation of contracts that bind the organisations together, and the behaviours induced by these contracts. They must further establish the necessary negotiation skills, the types of control that would need to be exercised, together with incentive and sanction systems to be implemented, to optimise coordination between

organisations and maximise the effectiveness of the network (Hayes, 2008; Luo, Xu and Li, 2005).

To illustrate the network links, during a round table conference, delegates Grunwald, Coppys and Edington, quoted in Baker (2011), noted that Evonik Degussa, a leading European speciality chemical manufacturer, has placed its personnel in their chemical distributors' businesses to improve understanding, resolve issues and improve cost effectiveness, eventually seen by the end customer as reduced total cost to market and improved service. It was noted that feedback is critical to check on agreement and direction, while distributors closer to the customer give producers' vital information and distributors establish if their capital investments align to the value drivers of their target markets. To ensure "principals and distributors have this important communication they must establish links between them at various levels in the companies: in logistics, in marketing and at the most strategic senior levels" (Baker, 2011, p.39).

2.3.2 Logistics and logistics management

Found within the operations discussed thus far is the logistics component of the business. The Council for Supply Chain Management Professionals (CSCMP) (2011) defined Logistics Management as "planning, implementing, and controlling the efficient, effective forward and reverse flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements." The activities of logistics management will include logistics network design, warehouse and materials handling management, order fulfilment, inventory management, supply/demand planning, inbound and outbound transportation and fleet management, and management of third party logistics service providers, and will be involved with customer service to a degree. Logistics management is an integrating function that integrates logistics functions with the marketing, information technology, sales and finance functions while optimising logistics activities (CSCMP, 2011). Gattorna (1988) also asserted that goods and information are moved through the company and its sales channels in a way that maximises "current and future profitability through cost-effective order fulfilment". The key "decision areas" of logistics management are: communication, facilities, inventory, unitisation, production scheduling, materials management and

transport. Dr Bowersox (2008) further emphasised the need for logistics management to meet the customers' time and place needs at the least total cost, while utilising minimum assets and promoting top line income growth for sustainability. Customer value creation relates to relevancy and sustainability is the result of continuous improvement (Bowersox, 2008).

These concepts tie in with the Lean Methodology concept which eliminates handling and all kinds of waste and streamlines business processes through analysis, re-engineering, standardisation, simplification of processes and continuous improvement (Saxena, 2009; Buxton and Jutras, 2006). Reinforcing the need for lean methodology, Campell (2011) reported that Canadian chemical distributors coped well in difficult economic times due to operating their businesses with a "Lean Mentality". Ittmann and King (2011) further asserted that streamlining for lean and resilient operations provides competitive advantage in a global environment that cannot be over-emphasised. Fortna (2011) also claimed that lean methodology can be effective in improving inventory management and distribution systems, with a 10 – 20% increase in productivity, achieved through elimination of handling and acceleration of product flows, and streamlining of processes. A four step approach is recommended:

1. "Establish goals, objectives, policies,
2. Assess current processes,
3. Conduct engineered studies, and
4. Add incentives."

This will assist to set up standard operating procedures and training to eliminate waste of time, resources and cost, "creating more value with less work". Buxton and Jutras (2006) and Saxena (2009) expounded on the value of a lean mentality in logistics and emphasised the need for on-going cross-functional analysis, brainstorming, training and motivation, which Saxena (2009) proposed resulted in rewards from "quick fix and incremental improvements". Angelis, Conti, Cooper and Gill (2011) reported a direct correlation between employee involvement in establishing the lean solutions, and their confidence in management's ability to execute lean distribution culture and strategies, to their motivation to achieve success with lean improvements. This further impacted the instilling of continuous improvement as a culture.

From a measurement perspective, Halley and Guilhon (1997) proposed that logistics performance is measured in terms of turnover growth and financial profits which are due to:

- 1) Effectiveness – the extent to which the objective is achieved using a means utilisation to objective attainment ratio, “doing the right thing”,
- 2) Efficiency – focusing on financial results using an output to input ratio (relating to anticipation of, response to and satisfaction of customer needs, and employee motivation, for value creation and cost control), “doing things right” and
- 3) Affectivity - ability to improve motivation and satisfaction of members of the organisation for “producing the desired affect” (Halley and Guilhon, 1997).

Bowersox (2008) argued that effectiveness relates to service excellence and efficiency leads to avoidance and minimisation of cost. Johnson, interviewed by Rodrigues (2002), stated that in order for a logistics organisation to be effective and efficient someone in the organisation must take ownership of the total logistics process. The different functional departments are too divergent and their scope of activities too limited, often with limited allocated resources or responsibility, to optimise intra and inter-company logistics operations proactively on their own. Companies that have someone open-minded to new methodology and analytical, driving changes and integration for logistics improvements from within are “recognised leaders in logistics” because they create the right environment and effectively manage changes and structures required to adjust to changing customers’ needs (Rodrigues, 2002). The logistics value proposition is to configure operations in a customer centric way while continuously improving quality and operational productivity and excellence (Bowersox, 2008).

Craig (2012b) suggests that the five key issues for effective logistics are:

- 1) Movement of product in a way that supports the corporate strategy, whether it is for reduced inventory, cost reduction or customer service excellence, with the emphasis on continuous product flow along the supply pipeline, with flexibility to adjust to business activity fluctuations;
- 2) Information movement, informing suppliers, carriers, internal functions, and customers, in a timely and accurate manner, of all relevant information relating

to position of product, volume, orders and due dates, bottlenecks or issues, (via numerous communication media and information systems) to allow for dynamic adjustment and sound decision making;

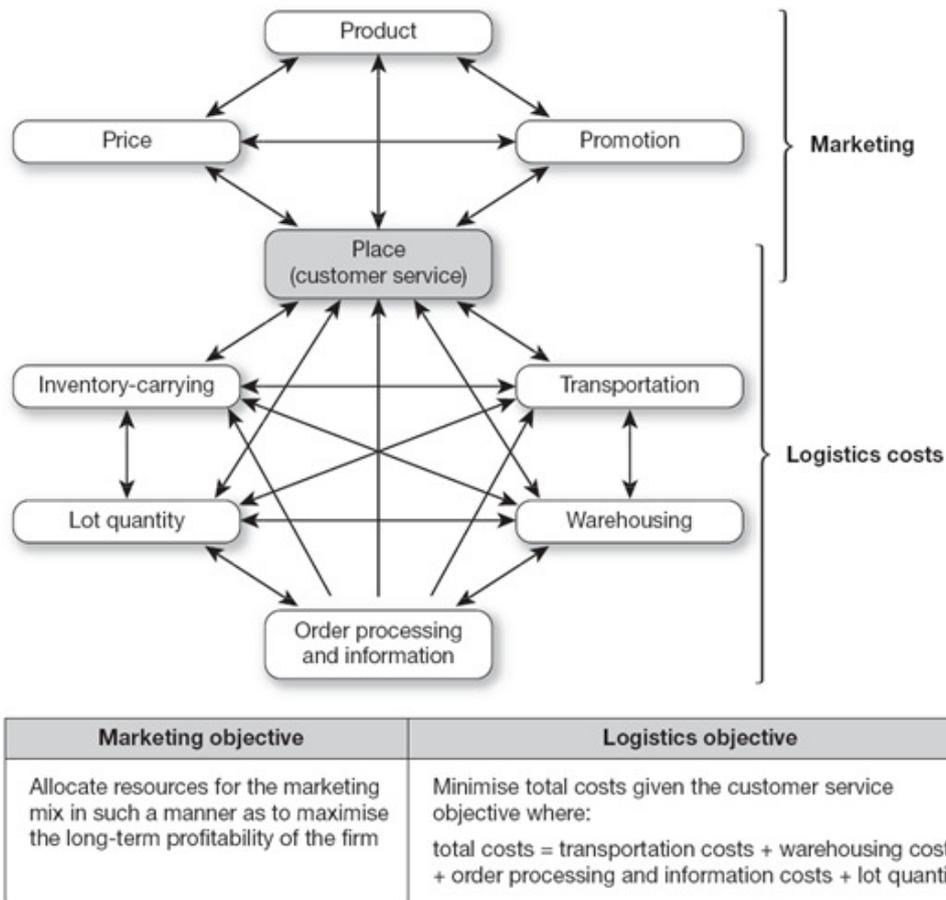
- 3) Time/Service - ability to integrate, respond and adjust quickly to changes in customer requirements and forecasts and new products, technology and conditions, while ensuring that procurement and order fulfilment are done, quickly, accurately and completely;
- 4) Cost containment - good stewardship of resources, assets and finances, without causing sub-optimisation in the supply chain and logistics network and negatively impacting customer service satisfaction, and
- 5) Integration of the functional areas of the company, breaking down silos, ensuring cooperation and visibility, for overall effectiveness of the total logistics process.

A one-on-one discussion directly with the customer to understand the 'what', 'how', 'why', 'where', and 'when' of his requirements will assist the company in planning and configuring an integrated logistics process where everyone is working together to meet the customers' needs (Craig, 2012b).

Boyson, Corsi, Dresner, Harrington, and Rabinovich (1999) stressed the importance of a multifunctional top management team supplying and coordinating physical and information resources for optimal logistics and distribution efficiency and effectiveness, with an integrated flow through departmental and functional processes and external organisations to form an extended enterprise. A seamless strategy, logistics and information synchronisation creates superior response times and gains while reducing inventory, improving planning, creating reactive operations, smoother product flows, lower costs, and improved customer service. Managing the extended enterprise calls for strategic control over physical distribution to the customer requiring "physical network management". It also requires dynamic knowledge management, to manage information and knowledge along the network for better visibility, speed, learning and improved performance. This is underpinned by the use of computer technology infrastructures that will be discussed later. (Boyson et al., 1999; Buxton & Jutras, 2006; De Villiers, Nieman and Niemann, 2010).

The concepts of extended and networked enterprises are further considered in the concept of the “supply chain”. Christopher (1992) defined the supply chain as “the network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer”. Referring to the chemical supply chain, Baker (2011) noted that chemical distributors need an effective span and size while also understanding their principals’ strategic investments and direction to achieve long term alignment with them, with the necessary transparency, professionalism, communication and information flow, technical capabilities and information technology infrastructure to provide a value added service to the supplier and end customer. This includes the need for performance monitoring with key performance indicators.

According to Rushton, Croucher and Baker (2010) *‘The Total Logistics Concept’* identifies and views the internal and external elements of the supply chain as an integrated structure, coordinating components for optimal system performance. A planned approach for identifying necessary cost and efficiency trade-offs within and between the different elements of an organisation’s warehouse and distribution model prevents sub-optimisation and coordinates the components in the best way for the overall system to perform optimally. This includes consideration of the interface between the functions, such as marketing, sales, administration and finance, as well as external partners and stakeholders. De Villiers, Nieman and Niemann (2010) defined the linkages between the aspects of customer service and logistics as seen in Figure 2.4, which clearly illustrates the Total Logistics concept and the balance required to achieve excellence and profit maximisation while considering the cost trade-offs.



Cost trade-offs in marketing and logistics

Figure 2.4 Cost trade-offs

Source: Stock and Lambert, 2001, cited in De Villiers, Nieman and Niemann, 2010, p.175

The four P's illustrated in the marketing function of figure 2.4 have the potential to give the company the distinctive edge between what it offers and the competition offers. The logistics function ensures the movement of products and integrates the functions and activities that ensure efficient delivery to the customer. This includes the order processing and information, lot quantity, inventory carrying costs, warehousing and transport. This all culminates in "place" value to the customer (De Villiers, Nieman and Niemann, 2010). Rainbird (2004) argued that the various processes will not necessarily work together and often have conflicting objectives. A process-based view of the company shifts the focus from the individuals, functional groups or departments who are responsible for the activities onto the activities that the organisation performs. A company selects which opportunities to pursue. This requires trade-offs that determine the resource allocations and development of the company's core competencies. Management of strategic

business processes affect the form, boundaries, structure and power within the company's design (Rainbird, 2004). Constant realignment of the company's core processes to changes in its environment demonstrates its proactive ability to manage, mitigate internal conflicts and costs of the interactions and create value by synchronising what the organisation can provide to what the customers demand. The ultimate goal of the total logistics concept and the process-based view is a balanced equation of logistics cost containment, customer service excellence and profit maximisation (Rainbird, 2004; De Villiers, Nieman and Niemann, 2010; Rushton, Croucher and Baker, 2010).

2.4 The Importance of logistics to customer service

Eberhard (2012) notes that chemical distributors provide services to both the chemical producers and chemical processors. Often these groups have opposing needs to be met by the distributors. The service provided to each of these 'customer' segments is illustrated in figure 2.5.

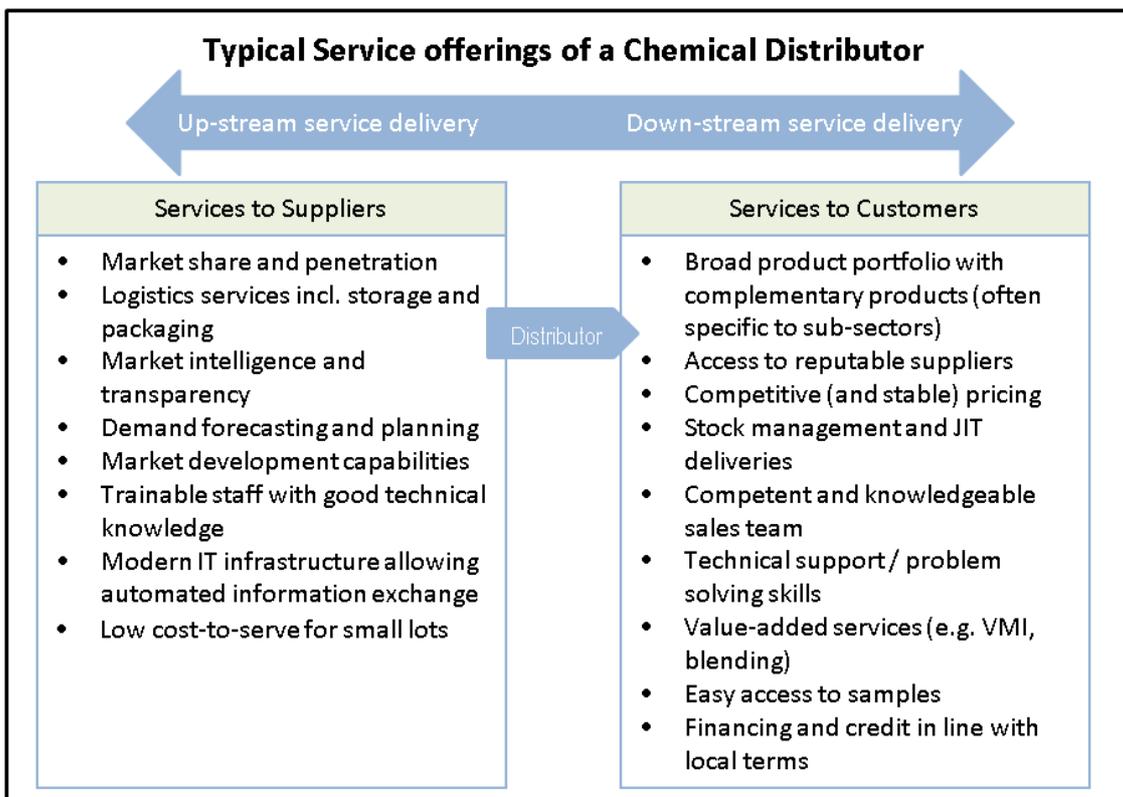


Figure 2.5 Service offerings of a chemical distributor

Source: Eberhard, 2012, p.7. Used with permission from DistriConsult GmbH, 2012

Figure 2.5 highlights the need for JIT delivery and supplier reputation, as well as value added services and easy access to products on the customer service side of the chemical distribution value chain (Eberhard, 2012, p.7).

As illustrated by figure 2.4, the logistics and distribution function is intimately involved in providing 'time and place' utility to the customer, which is the ultimate outcome of customer service, facilitating ownership as it creates the physical link between the customer and the supplier (Hall, 2010; Ittmann and King, 2011). Christopher (2011, pp.29-31) defined customer value as an equation of the customer's perception of benefits received over total cost of ownership:

$$\text{Customer value} = \frac{\text{Perceptions of benefits}}{\text{Total cost of ownership}}$$

Grant (2010) suggested that rather than cost cutting for 'efficient logistics' the company's focus should be on 'effective logistics', thereby maximising profit. The company's service levels provided may be higher than what customers themselves would have expected. Customer complaint analysis, although not a complete solution, shows commitment and impacts trust and the customers' value perception, and provides a "moment of truth" opportunity to adjust (Grant, 2010). Christopher (2011, p.34) stated that "The order winning criteria are those elements of the offer that have a clearly identifiable positive impact upon the customers' own value-creating processes". The recent recession, new competitive sources and the internet have raised the increasingly sophisticated customers' consciousness of value. With industrial buyers expecting ever higher service levels, increased demand for just in time (JIT) deliveries and more products transitioning to commodities as product technologies converge and brand recognition diminishes, customer service is paramount to success (Christopher, 2011). For the distributor the whole company providing a unique offering from that of its competitors offers powerful potential for differentiation (Porter, 1985). In the new economy it is essential to retain customers through excellent, fast and responsive service that is continually improving (Hayes, 2004).

Craig (2012a) asserts that companies that view their supply chain as a cost, associated with warehousing, transport and related costs have a myopic view that traps them into defining themselves as providers of commodities with price as their key competitive differentiator. Understanding instead the impact of on time, in full and complete orders, with a short cycle time, from a well-managed supply chain logistics operation, offering a value proposition to their customers is vital for success (Craig, 2012a). The product or service being available to the customer is affected more by stock availability, delivery reliability and cycle times than the traditional focus of competitive pricing and marketing (Christopher, 2011). Mentzer and Williams (2001, p.30) further noted the difficulty of “maintaining a differential advantage accruing from changes in product, promotion, or price”. As products become more homogenised these are temporary components of service. Therefore the commodity product should not be confused with a commodity business. Rather create customer value by leveraging logistics through attainment of superior, excellent, “infrastructure-based logistics performance”, executed within an effective marketing strategy (Mentzer and Williams, 2001, p.30).

It is not only logistics and distribution, but also advertising, packaging and branding that can influence the customer’s perception of value. However, while marketing focuses on getting customers to increase market share there is increasing realisation in both marketing and logistics that by building relationships and retaining customers, sales volumes and profitability are increased. This is because satisfied customers become loyal, are less price sensitive, increase frequency and volume of orders, and are less likely to look elsewhere for products as they build strategic partnerships with effective, reliable, responsive and resilient suppliers, and are more likely to tell others, indirectly increasing market share (Mentzer and Williams, 2001; Bowersox, 2008; Hall, 2010; Christopher, 2011). Therefore, a sustainable “positional advantage” is possible not through changes to the commodity products but, how the products are distributed, through leveraging of logistics as an important “value added” service recognised by customers, since the business infrastructural changes required make it difficult for the competition to match (Porter, 1985; Mentzer and Williams, 2001, p.30).

According to Kunz and Dow (2011) “A chemical distributor adds value by supplying its customers with the chemicals they need, in the quantities they desire, when they need them”. This emphasises the need to truly understand the customer. The previously discussed shift of power from the supplier to the customer and effect of the ‘new economy’ and technology has changed the paradigm from a “supply chain” to a “demand chain” (Poirier, 2005; Christopher, 2011). Understanding the needs, wants and structure of the customer informs the design of the supplier’s networks, supply chain, value chain, leadership style, culture, capabilities and actions needed for performance improvement, because the company’s strategy and objectives now need to align with the customer’s value chain (Gattorna, 2010; Christopher 2011; Mentzer and Williams, 2001). “As part of integrating key customer requirements into chemical company logistics capabilities” distributors need to distinguish the supply chain values pursued by their key customers and use their requirements to create a distinctive logistics approach for each value segment. Chemical distributors have lagged other industry sectors in customer segmentation because they do not acknowledge that “not all customers are equally important”, and therefore don’t develop tailored processes and supply chains for leading customers. (Closs, Mollenkopf, and Keller, 2005, p.207).

Gattorna (2007 and 2010b) referred to empirical studies which showed that companies that performed consistently better than others in all industries were those where the leadership had an intense understanding and empathy for the industry and their customers and understood the customers’ buying behaviour. This informed their strategies and internal alignment, where market segmentation is done according to customer buying behaviour rather than product and other traditional segmenting methods, which are misleading and ignore the true customer requirements. The majority of suppliers have an insufficient level of understanding of customer buying behaviour due to lack of focus in this area. Where there is some understanding it is held up in silos in the marketing and sales department, where the rest of the operations are left guessing how to structure their service offering to meet customer requirements (Gattorna, 2007 and 2010a). Empirical studies have identified four dominant buying behaviours which segment the market and define the required supply chain design as reflected in figure 2.6.:

Collaborative	Efficient	Dynamic	Innovative Solutions
Close Working Relationships for mutual gain – Mostly predictable – Regular delivery – Mature or augmented products – Primary source of supply – Trusting relationship – Teamwork partnership – Information sharing – Joint development – Forgiving – Price not an issue	Consistent low-cost response to largely predictable demands – Predictable demand within contract – Regular delivery – Efficiency low-cost focus – Multiple sources of supply – Little sharing of information – More adversarial – Standard processes – Power imposed – Transactional – Very price sensitive	Rapid response to unpredictable supply and demand conditions – Unpredictable demand – Commodity relationship – Time priority/urgency – Opportunity focus – Ad hoc source of supply – Low loyalty, impersonal – Fewer processes – Outcome oriented – Commercial deals based on pragmatism – Price aware	Supplier-led development and delivery of new ideas – Very unpredictable demand – High risk – Flexible delivery response – Innovation focus – Rapid change – Individual decision making – Solutions oriented – Management of IP – Incentives/ ego – No price sensitivity

Figure 2.6 Four most dominant buying behaviours
 Source: Adapted from Gattorna, 2010b, p.128

The four dominant buying behaviours or segments identifiable in a market place are Collaborative, Efficient, Dynamic and Innovative Solutions. Figure 2.6 lists the defining fundamentals for each of these behaviours. When the “behavioural structure of the company’s marketplace’ is understood it is possible to reverse engineer the supply chain back to internal operations on the ground”. There is likely to be more than one type of supply chain configuration required for service in the chosen market because there is normally more than one dominant customer buying behaviour present in any market based on the country or category of product/service. The company can then develop a matching array of aligned responses to the relevant buying behaviours identified, as packages of attributes: relationship, branding, price, speed or frequency of delivery, level of innovation, and mix of products (Gattorna, 2007). Christopher (2011, p.211) referred to this as designing the distribution chain from “the customer backwards” rather than “outwards” from the centre of the distributors’ organisation.

House (2004) cautioned that companies that focus inward for answers to what the organisation should be doing could face extinction, because they make more decisions by relying on their Executives’ views, reports and ideas of what customers want, than on focusing outwards with interactions and consultations

with customers and suppliers to understand the external and internal issues that affect customers. They 'second guess' their customers' needs based on a firm belief that they already know what the customer wants, pushing customers away with their arrogance. Strategic Direction (2006) suggested that while top management need to be confident in order to make difficult decisions they must avoid hubris, which results from over-confidence that becomes arrogance. According to Kioll, Toombs, and Wright (2001, p.126) "When leaders have achieved success they must not allow hubris to erode their hard-earned accomplishments". They can become victims of past successes, believing that by experience they already have all the answers and know the market and products and what their organisations internal needs and customers' needs are. Hence they fail to engage their lower levels who deal with the daily challenges or ask their customers, peers and suppliers how they are doing and what they need to do to meet the customer's needs and improve their profits. Previous high performance can lead to a sense of infallibility and excessive risk taking, believing that the usual rules of the game no longer apply to them. By arrogant assumption management believes that the future will imitate patterns of the past that secured their success. Authors cite examples of Delta Airlines, Wal-Mart Germany and Ford Motor Company losing shareholder value due to management hubris. Leaders over-estimate synergies and will not understand the reason for decline due to relying on 'faulty data', usually filtered by internal management, because their hubris prevents them from viewing their operations objectively, listening to new and differing views or doing the necessary market research (Kioll, Toombs, and Wright, 2001; Raj and Forsyth, 2003; Strategic Direction, 2006; Mishina, Dykes, Block, and Pollock, 2010). Through astute market research the company gains understanding of the customer service needs that create the 'service segments' based on the customer buying characteristics (Christopher, 2011). While the company does scan the environment and where necessary react to what its competitors are doing, it does not seek to imitate what they appear to be doing 'right' without first understanding what the customer wants, as they may be structuring their offering in a way that does not align with the customers' long term needs (Gattorna, 2007; Mentzer and Williams, 2001).

Gattorna (2007, 2010b) noted that empirical studies had defined four generic supply chains to correlate to the aforementioned dominant customer buying behaviours. The salient points of the correlating buying behaviours and required supply chain structures are reflected in figure 2.7.

Market segment	Collaborative	Efficient	Dynamic / Demanding	Innovative Solution
Supply Chain	Continuous Replenishment Supply Chain	Lean Supply Chain	Agile Supply Chain	Fully Flexible Supply Chain
Required	Close working relationships sought with selected suppliers	Require relentless focus on cost and efficiency	Response required to unplanned or unforeseen demand	Creative solutions required, very fast
Value Proposition	Share information Strategic partnership Long term stability Mutual trust	Seek economies of scale Low cost production and distribution Forecast demand; mature products; predictable lead times	Fast decision making Fast delivery Rapid response in unpredictable conditions	Meet unplanned/unplannable demand Innovative solutions, delivered fast
Leader Style	<u>Coach</u> Conscientious Lead by teaching Concerned for others Loyal; committed; politically astute Seeks agreement by consensus	<u>Traditional</u> Leads by procedures Implements only proven practices Cost controller, efficiency focused Use info. to control Seeks stability Is risk averse	<u>Company Baron</u> Lead by objective (MBO) Embraces change Goes for growth Focuses on what's important Analytical; fact based negotiations	<u>Visionary</u> Leads by inspiration; is authentic Informal Decisive Cares about ideas Values innovation
Internal Cultural capability 1 Design 2 Process 3 IT 4 KPIs 5 Incentive 6 Job Des 7 Int Coms 9 T & D 10 Recruit	Relationship 'cluster' Std, Cust. Acc. Mngmnt CRM, VMI, ECR, CPFR Loyalty & retention Participative schemes Auth/Autonomy negot. by consensus Consultative face to face Team Building Team players	Around core processes Std, emphasis – cost ERP systems DIFOTEF, forecast, productivity ratios Conform to policies Central control – rules and regulations Regular, structured 'need to know' Analysis & Measurmt Analytical skills	Clusters: speed/effic. Short cut/fast response Application, SCP, APS Speed of response Target – cash & kind Auth/Auton. Establish. by clear limits Formal regular action oriented Problem solving, resource allocation Result driven people	Small multidisciplinary No std, use initiative Low system requiremt Fast creative solutions Reward individual Autonomy through empowerment Spontaneous, informal Lateral thinking, brain storming Enterprising, resourceful

Figure 2.7 Supply chain configurations to align with dominant customer buying behaviour.

Source: Adapted from Gattorna, 2010b, pp.132-135

It is noted from figure 2.7 that in order to effectively align the company's logistics supply chain configuration to the customer's buying behaviour the company must consider its value proposition and leadership style, as well as its internal cultural capabilities required for each market segment. The key to success in logistics is to understand the customer, their behaviour and needs (Gattorna, 2007, 2010b; Ittmann and King, 2011; Christopher, 2011). Networked organisations start with what is needed for "a competitively advantaged value network in the eyes of the end customer" to establish what should be done across the network to accomplish the superior desired outcomes. It starts with enhanced forecasting, and via necessary linked processes uses network resources for superior, efficient distribution, effective inventory replenishment, collaborative marketing strategies and an outstanding system of order fulfilment (Poirier, 2005).

Grant (2010) referred to the "perception gap" that relates to the customers' expectations and perception of service satisfaction and the suppliers perception of the customers' expectations/ needs and their success at satisfying them. The emphasis is on understanding the needs, translating them into service specifications and measurements of performance and correctly "communicating intentions and actions to customers". The company will work to minimise the gap to improve the overall customer service experience (Grant, 2010). Christopher (2011, p.40) recommends a three-step process:

- 1) "Identify key components of customer service as perceived by customers themselves.
- 2) Establish their relative importance to the customers.
- 3) Identify 'clusters' of customers according to similarity of service preferences to develop a set of service criteria that are meaningful to customers".

Recognise the important core influences on the buying decision and know from involvement who are the decision-makers. Traditional classification of customers based on industry sectors does not necessarily relate to the attributes they search for from suppliers (Christopher, 2011, p.40).

Swanepoel and Arntzen (2011, p.52) reported that during a two year international study a survey of middle and senior managers revealed that the majority of

companies believed their service “successfully mirrored their customers’ sense of urgency when it comes to supply chain performance, yet simultaneously rated their suppliers as being mediocre in this regard”. The differing perceptions of alignment were noted where managers in South Africa believed their customers’ perception of their service performance was better than what was actually the case. The same survey revealed the risks regarded as most significant by customers in South Africa as demonstrated in Figure 2.8

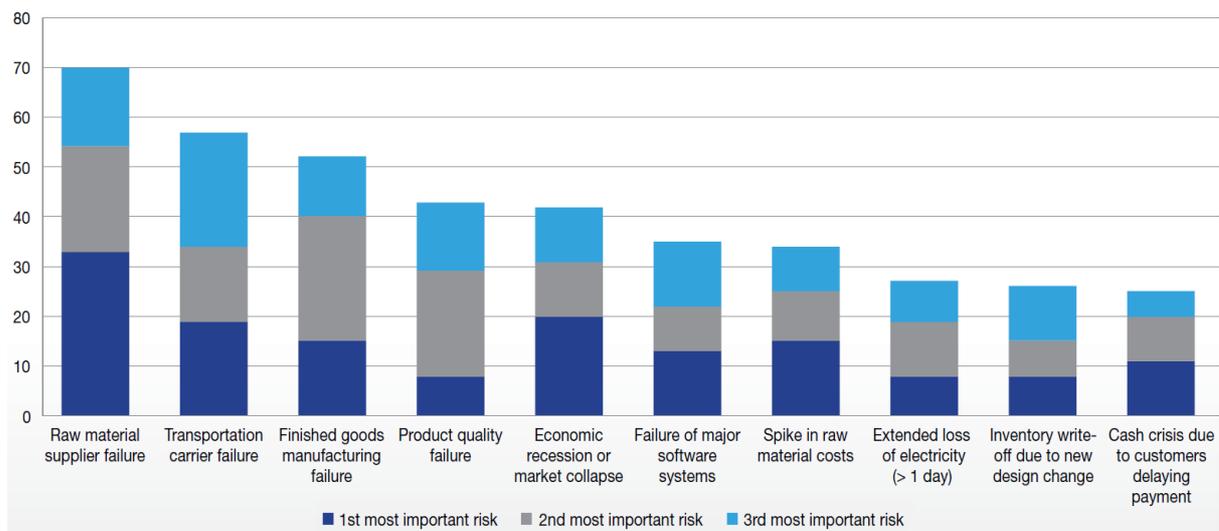


Figure 2.8 Supply chain risks.
Source: Swanepoel and Arntzen, 2011, p.53

Figure 2.8 highlights the significance of raw material distributors with the raw material supplier failure being regarded the number one risk by customers. The importance of logistics is also highlighted with transportation carrier failure rated second. Raw material distributors could impact at least five of the ten most important risks to customers when including product quality failure, spike in raw material prices and inventory write off due to design change. The study further revealed that the majority of South African companies are ineffective in collaborating with customers and suppliers to mitigate the supply chain risks. For organisations there is a greater frequency of internal operational risks than those that occur externally and outside of management’s control. However, the internal risks are not as severe as that of drawn out labour strikes and on-going electricity power failures, which are unique to the South African environment context. This phase of the study revealed that South Africa still compared well against the

'consumer countries' for supply chain risk factors. It was nonetheless noted that not enough is being done to manage internal and external logistics and operational risks, so that logistics managers are constantly 'putting out fires' with big and small crises along the value chain. "In light of the pivotal role that logistics plays in company performance" it is vital that all types of risk are identified, managed and communicated to be effective in the supply chain and customer service (Swanepoel and Arntzen, 2011).

The crucial message is that the excellence of "customer service performance depends in the main upon the skill with which the logistics system is designed and managed" (Christopher, 2011, p.54). However the logistics improvement and excellence cannot be leveraged for customer value perception unless the customers are made aware of its existence. By knowing what customers care about and marketing the effective logistics performance to them the true value is realised, further illustrating how logistics and marketing are intertwined (Mentzer and Williams, 2001).

2.5 Information systems that may enable logistics efficiency

Buxton and Jutras (2006, p.9) asserted that differentiated service, to capture customers and deliver products effectively, is driven by technology that supports "streamlined and integrated lean value chain processes". Correlating with Campbell's (2011) statements regarding the need for efficiency and reliability in the competitive chemical distribution industry, information systems are vital for efficient processing and value chain activities, sharing information internally and with supply chain partners, for monitoring, feedback and measurement of efficiencies and profitability. This allows management to make the necessary adjustments, re-allocate resources, and react quickly, to allow for the flexibility required in the face of changing supply and demand (De Villiers, Nieman and Niemann, 2010; Vlčková, 2008; Nickel, 2006). Christopher (2011) noted that technology is a driving force enabling the linkages in the supply chain, with companies organising around their information system capabilities, to capture market demand information, anticipating customer requirements and schedules and matching processes to meet their demand. The new information systems are changing organisations to horizontal structures, using shared information to

become demand-driven, and to open up opportunities for “end-to-end pipeline management”, with inter-functional order fulfilment and improved logistics capabilities to offer high level service at minimum cost (Christopher; 2011).

Furthermore, with the constant change in chemicals handling policies for protection of human and environmental safety new information technology solutions can support distributors in differentiating themselves as responsible business partners, showing commitment and compliance to required standards in their logistics operations (Engel and Roofls-Broihan, 2006). However, according to Closs, Mollenkopf and Keller (2005, p.207) chemical companies are poor at internal and external information sharing and management, and “lag other industries in accurate, timely and consistent company-wide data, having high levels of data redundancy and fragmentation within their organisational databases”. Tracking inbound shipments and coordinating distribution to enable commitment to accurate customer delivery times are internal communication capabilities in which chemical companies need improvement. Nickel (2006) proposed that to apply in-house knowledge effectively requires knowledge management, plus efficient IT and management teams, with appropriate technologies and a good intranet that allow for quick and easy data mining. The importance of information technology in logistics operations and the supply chain is understood from the top five supply chain objectives noted in figure 2.9.

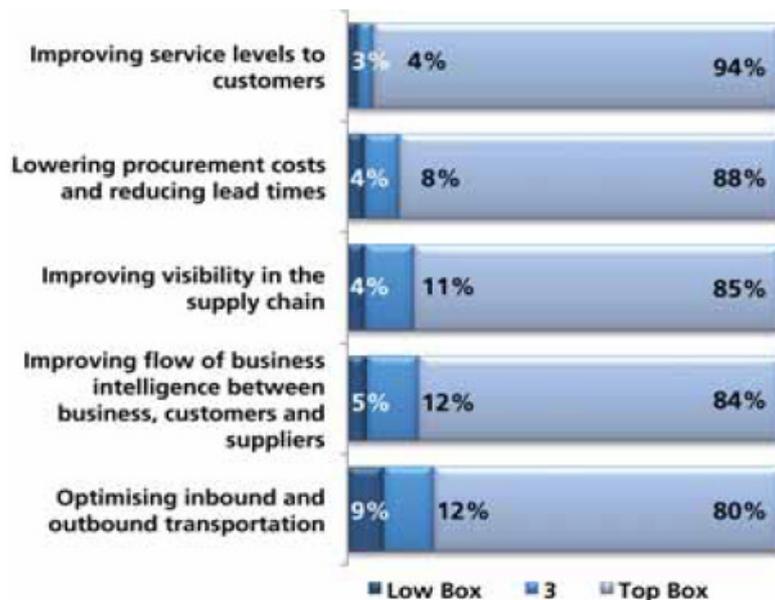


Figure 2.9 Top 5 supply chain objectives
Source: Barloworld Logistics, 2012, p.6

The respondents in the Barloworld Logistics Supply Chain Foresight survey (figure 2.9) highlighted the need for improved service, lowered costs and reduced lead times, improved visibility and flow of information between business partners. “In industries where the competitiveness of the supply chain is critical to success, the information flow objective is supported by every single respondent” (Barloworld Logistics, 2012, p.6). According to Rasch (2006) and De Villiers, Nieman and Niemann (2010), the speed and accuracy of the required integrated processes is strongly reliant on the availability of information systems that provide a common database with integrated, automated processes and functions, such as those supplied by Materials Requirements Planning (MRP) and Warehouse Management Systems (WMS), integrating with Accounting and Finance, Customer Service, simulation opportunities and on-line customer order confirmation. These are reliant on real time inventory records for service optimisation. This is usually available in the new generation Integrated Enterprise Resource Planning (ERP) Systems (Rasch, 2006; and De Villiers, Nieman and Niemann, 2010).

ERP Systems and WMS integrate functions and processes and increase information flows, enabling alignment of supply and demand and forecasting. It ensures necessary resources and capacity for receiving and storage, picking, collating, marshalling, loading and despatching, to fulfil customer orders efficiently at low cost. They increase transparency and visibility throughout the value chain, improving collaboration and reducing processing and paper flows. The WMS is capable of basic batch tracking, bin location, bar codes, hand held radio frequency device, labelling, and Radio Frequency Identity (RFID) tagging management, to more complex and capital intensive robotic and automated materials handling systems. They further integrate with Transport Management Systems (TMS) which offer transportation models, load correlation and planning, route planning, vehicle tracking, advanced shipping notification, global positioning systems (GPS), maps, time and distance support and control, fleet maintenance, inter alia, including planned labour requirements, which optimise both in-house transport capacity usage and streamlining of third party logistics. The use of WMS automation, facilitating remote label printing, batch tracking and bin location allocation, simultaneous, multiple order receiving by product and automatic inventory level updates, improves accuracy and speed, reduces breakages, reverse logistics and

stock obsolescence, while supplying real time information. The systems include Business to Customer (B2C) interfaces for online order processing and tracking, access to various types of information and offer shorter lead times (Aberdeen Group Inc., 2007; Baker and Halim, 2007; Le Pree, 2007; Collins, 2008; Friedman, 2010; and De Villiers, Nieman and Niemann, 2010). From their TMS research Aberdeen Group Inc. (2007) reported a strong correlation between use of WMS and TMS and reduced inventory, inventory holding costs, warehouse and logistics costs.

CHEManager (2009) further reported the benefits of Telemetry systems, which use electronic measuring and telecommunication for remote monitoring, and Business to Business (B2B) software interfaces used by chemical distributors to monitor and manage their customers' inventory levels and replenishment requirements, effectively reducing their customers' ordering and administration costs, improving downstream supply chain visibility, returnable drum and pallet management, forecast accuracy and logistics planning, and increasing their customers' reliance on them as a main source supplier. This transforms the relationship to one of buying agent and vendor managed inventory, rather than a remote arms-length supplier relationship. Beesley (2010) also noted that information technology offers tools for the management of time compression (discussed later under best practices), discovering, planning, realisation and implementation of new processes. It then assists in monitoring and measuring of physical performance against time based objectives for continuous process improvement and governance and management of required change, with system alerts for variances from standards. This reduces customer order lead times and improves distribution management efficiencies.

Kannegiesser, et al. (2009) recommended intra-organisational information sharing and planning along the chemical industry supply chain, to mitigate price and volume volatility and plan foreign exchange hedging. Vlčková (2008) suggested that doing this monthly, using data available from MRP and other systems, to determine seasonal trends, safety stock requirements and optimal order quantities, will ensure correct stock levels and assist in reducing stock obsolescence, giving the company competitive advantage. He did however admit,

and De Villiers, Nieman and Niemann (2010) agreed, that this would require strong leadership and a change in current thinking and relationships among stakeholders along the supply chain.

Friedman (2010) however cautioned that information systems are not a panacea to all warehouse and outbound logistics issues. He noted that it takes capital investment and training, planning and preparation to ensure that the warehouses are correctly laid out and structured, with the necessary resources and employees ready to integrate and use the technologies. Rasch (2006) noted that “the transition process requires dramatic changes in the entity’s business model, mind-sets, and behaviours, and has huge implications for supporting IT systems”. Baker and Halim (2007) concurred and noted that automation would be more viable in circumstances of long term demand and predictability. High levels of investment in automation introduce rigidity. Difficulties with inappropriate selection, insufficient maintenance, and difficulties experienced in reconfiguring for changing business needs, have been reported as causes of inefficiencies and sunk costs. It was suggested that this is mitigated when scaled to large and established warehouse operations. Balocco, Miragliotta, Perego and Tumino (2011) further reported a disappointing gap between expectations and achievements and disappointing returns on investment in technology. In fast moving commodity goods the initial outlay, questionable profitability and perception of the reliability of RFID has affected its adoption in spite of it being the most powerful electronic ID available today (Visich, Suhong, Khumawala, and Reyes, 2009).

Nonetheless, all physical activities in the value chain have components of information and processing activities in and permeating between their linkages throughout the operations (Porter and Millar, 1985). The information is initially expensive to produce and then becomes inexpensive to reproduce. It grows in depth and value with use and refinement as it is shared in a networked environment, but needs a common framework and standard, with reliable interfaces and effective collaboration. The efficient and reliable flow of information has become critical to the effective flow of goods, reduction of inventory, outbound logistics, service activities and on-time deliveries, with good coordination in

geographically diverse operations. The challenges and opportunities facing management are:

- coping with the overflow of too much information and filtering knowledge and best-in-class processes to create 'institutional knowledge',
- focus on required core competencies,
- the merging of IT and telecommunications,
- the effect of information technology on procurement and selling and buyer power,
- the lowering of activity costs, effective use of customer interfaces for value added activities and to increase customers' switching costs, for ultimate competitive advantage.

The effective use of IT for improved operations requires active involvement of management at all levels and their sophisticated understanding of IT implementation for usage, planning and forecasting, real time control of processes, data collection, specialised analysis and operational and financial performance measurement (Porter and Millar, 1985; Hayes, 2004; Nickel, 2006). The supply chain operator who seeks maximum access to information technology and information systems at minimum cost, reduced infrastructure requirements and less requirement for skills and knowledge of these technologies may opt for systems hosted by other organisations in the 'cloud' through internet and telecommunication technology (Dominy et al, 2011).

2.6 The relevance of best practices

Birnbaum (2006, p.234) noted that in order for chemical companies to bring about organisational transformation for excellence in operations, organisations need an understanding of their core processes and the best practices needed for their particular situation. "Despite all the successes of the past, many chemical companies still have a long way to go to arrive at such 'best practice' setups". It was noted that benchmarks are difficult to establish in the chemical industry due to the differences in products, their safety and handling requirements and regulations (Birnbaum, 2006, p.234). However, laggards regard the status quo as the best possible performance with current investments (Poirier, 2005). Leaders constantly assess capabilities, systems, processes and networks, sharing knowledge and

innovation to identify, capture and codify best practices, adjusting network designs and business processes and techniques to establish and sustain leading edge customer-focused service delivery throughout its internal and external networks for competitive advantage (Poirier, 2005; Buxton and Jutras, 2006). In their white paper on logistics The Descartes Systems Group Inc (2012) also asserts that in order to gain competitive advantage by improved cost containment and exceptional service through streamlined delivery, each company needs to identify and integrate best practice business processes into their organisation.

Rutkowski (2010) noted that managers, fighting to optimise operations for survival, are using 'best practice' metrics to measure their operations against their competitors. There is a tendency to copy those practices which appear more effective or efficient, integrating and translating methods and practices working successfully in other organisations into their operations as 'best practice' philosophies. However, the term "best practice" is often confused with the latest fad or trend, and even best practices of today are quickly superseded. True 'Best Practices' are enduring, superior and leading edge models of processes, policies, concepts, procedures, activities, information, initiatives, human resources, technology and organisation that create a framework for operating at exceptional levels of performance and securing competitive advantage. It is a model for others to follow without having to reinvent the wheel and having the same problems others have already experienced. It is demonstrated by unique success and rejection of mediocrity (Rutkowski, 2010).

However, Rutkowski (2010) cautioned against believing that all 'best practices' are a transferrable 'one-size-fits-all' solution, to improve any company. While some may be universally applied to any organisation in the world, some best practices will be best in their precise context, or business situation, so that when transferring them to another organisation with its own idiosyncrasies, size, capitalisation, human resources, corporate culture and strategies, market, competitive environment, geographic region, industry, technology, regulations, amongst others, they will require tailoring (Rutkowski, 2010). Simply copying practices without taking account of the conditions in which they were developed will result in errors and sub-optimisation. A 'best practice' is better seen as a business model to

be learned from, translated (imported with necessary adjustment) and institutionalised, but organisations operating in an environment of continuous change will need to continually assess the underlying premises of their established best practices with energy and commitment from senior management. While the identification and implementation of 'best practices' for achievement of unique and extraordinary operating techniques and superior competitive performance may seem unattainable, those organisations that have striven to achieve them have reported better results than their competitors and are role models to be imitated (Birnbaum, 2006, and Rutkowski, 2010).

2.6.1 Best practices identified for efficient logistics operations

2.6.1.1 Time compression

Craig (2012a) notes that leading companies seek to compress cycle times: the time from identification of a need of replenishment until the time the goods are in the store, or the time that the client's need is identified to the time the order is delivered on time, accurately and complete, with best-in-class companies doing this consistently and reliably. Beesley (2010, p.72) noted that companies seeking faster turnaround time on delivery and customer service often sacrifice quality in the quest for speed. Time compression relates to improving the whole logistics structure with a "time based focus" and taking wasted processes, activities, documentation and complexity out of the logistics system to enable a quick response to customer order fulfilment needs by setting "time based objectives with tactical decisions, made at the correct level, to enable speed of response". A time compression strategy will identify all value adding processes in the value chain and their time frames and earmark them for speed, quality and efficiency improvements, while eliminating those activities and process that do not add value to the process and ultimate customer satisfaction. Christopher (2011) noted that the cutting out of non-value added activities and controls will also reduce the cost to serve the customers, reduce capital requirements and reduce the cash to cash cycle (time of payment for inventory procured to receipt of payment from the customer). It is further suggested that the longer the lead time in the supply chain the more room for errors in forecasting replenishment requirements. Therefore time compression will reduce the reliance on forecasting, improve supply and

demand management and reduce customer order lead times, which in a competitive commodity or just in time environment is critical to survival and differentiation. It is recommended that time compression is used as a performance measure when aiming for “the perfect order” (Beesley, 2010, and Christopher, 2011).

Time compression may require reorganising of inventory storage and supplier inventory delivery processes, process re-engineering, and the redefining of the organisational structure from functional silos to process driven, inter-functional, customer-centric teams and will demand excellent internal and external information flows and knowledge sharing (Beesley, 2010: Christopher, 2011). Beesley (2010) noted that time and cost based process mapping will have the added advantage of identifying “root causes” of problems in the customer delivery and distribution management system. The analysis will include the relevance of technology applications to the specific circumstances of the company to ensure that automated systems, processes and information flows are contributing towards effective physical logistics activities and better productivity. The recommended strategies for achievement of time compression include simplifying processes, integrating processes through stronger linkages and improved information, identifying opportunities for running activities concurrently rather than sequentially, standardising best practices and monitoring variances from standards for early detection of problems and quick corrective action, automation of processes and information flows for improved efficiency and careful planning, allocation and adjustment of resources (Beesley, 2010). The improved resource allocations include warehouse, transport, personnel, IT and third party capacity usage. There are software programs that can assist in the process mapping and analysis required for effective time compression (Christopher, 2011). Elements of the time compression concept and activities are further evident in the following warehouse management and transport and delivery service discussions.

2.6.1.2 Best practices for warehouse management

The warehouse objective is the transformation of a stored range of goods into an assortment of goods demanded by the customer, with regard for the quantitative, timely, qualitative and value demands of the customer (Bisenieks and Ozols,

2010). The key functions of the warehouse are provision of lowest total cost customer service and linking both the suppliers and customers to producers by transfer of products and information (De Villiers, Nieman and Niemann, 2010). Movement of goods through the warehouse, incoming, internal and outgoing flows, impact on the final cost of goods and value added to the customer. Warehousing and distribution is a critical part of the organisation's value chain and involves receiving, packaging, and transfer into warehouses, storing, order selection, despatch and shipping of goods. It requires precise interaction with other departments and alignment with the company's overall strategic objectives and future prospects for success and profitability of the operations. Top management will decide on private or outsourced warehousing, warehouse type, how many warehouses to have in which locations, warehouse plans, capacity requirements, what technologies, warehouse systems and logistics processes to use and linkages to other departments for the formation of an effective warehouse network, for cost effective and efficient distribution and customer service (Li, 2007; Rafele, 2004; Bisenieks and Ozols, 2010; De Villiers, Nieman and Niemann, 2010). Warehouse management will include rational planning, organising and control of work in the warehouse, loading activities, facilitating required equipment and effective use of people, space, technology, and equipment, and safe and secure handling and protection of the value of goods (Bisenieks and Ozols, 2010). Engel and Roofls-Broihan (2006) noted that the most effective and profitable chemical distributors are those who have the skills to maximise their warehouse and transportation capacity, with warehouses situated close to customers for reduced delivery costs and customer order lead times.

Hansen Harps (2005) and Collins (2008) recommended a central communication point for the use of Advanced Shipping Notification (ASN) from suppliers to inform warehouse management when to expect inbound deliveries and to customers to inform them of outbound deliveries, with effective scheduling, to improve warehouse and distribution asset maximisation, capacity planning and delivery turnaround times. This can reduce put-away, storage and picking activities when items are cross-docked directly from receiving to outbound transport. Buxton and Jutras (2006) questioned the wisdom of going through traditional warehouse

procedures of receiving, inspection, storage and picking when direct cross-docking to outbound orders is possible.

Coupled with a warehouse management system, and collaboration with suppliers for efficient information flows and product packaging for ease of handling and put-away, the planned receiving will ensure that the warehouse is prepared for the marshalling, batching, labelling and binning of inventory for lot number and first in first out despatching of goods. Efficient and cost effective warehouse management should include:

- 1) the use of “automated data collection technology”. Every movement of a product is recorded as a transaction, with the use of hands-free wrist scanners, voice activated picking technology, or hand-held radio frequency devices for efficient order picking, and the minimisation of touches for receiving, put-away, picking and despatch of each product.
- 2) concurrent picking of order parts allow for direct loading rather than being set down for collection from a marshalling area,
- 3) cross-docking,
- 4) system directed product slotting into optimal locations based on seasonal demand, and
- 5) a well-defined returns management system, for resale or disposal of products.
- 6) Cycle counts of specific products or locations to reduce full inventory count requirements.
- 7) Establish “Engineered Labour Standards” for improved productivity, handling and safety standards, with effective management communication to employees and supervisors, for monitoring and effective implementation of standards and best practices (Hansen Harps, 2005).

Hansen Harps (2005) and Roach Partridge (2006) further recommend the use of Six Sigma, which is a data driven quality measure that strives for perfection, driving towards six or less standard deviations between the mean for a process and the nearest specification limit to statistically describe how the warehouse or logistics process is performing. Used with its sub-methodologies it ensures continuous improvement and new processes for efficiency by understanding critical paths in the warehouse process.

Collins (2008) noted that receiving errors result in inter alia, inaccurate stock records, account payments, and customer backorders. Efficient receiving results in successful receipt and storage with the least movement, touches, scans and people as possible to reduce cost, space, time and capacity usage, errors and risk of damage. This is enabled by enforcing good labelling standards with suppliers, which allow for clear reading and scanning of stock keeping unit information on the products and pallets, with the right data capture devices available for paperless receiving and communication and a well laid-out and labelled warehouse, using a strict labelling regime. Shelves and locations are properly labelled, stock labels face outward for ease of recognition and scanning, and changes in location and packaging are kept up to date on labelling. Lack of enforced supplier shipping standards, with incorrect delivery modes, timing, packaging, labelling, missing documents, purchase orders or product, creates additional handling and administration and negatively impacts speed, accuracy, productivity and profits. It is recommended that “vendor compliance procedures” be published, communicated to and enforced with all suppliers and internally, with relevant sanctions and remedial steps laid out for non-compliance. Use a supplier efficiency and dependability ranking system and possibly eliminate repeat offenders with high negative margin impact from the vendor list (Collins, 2008).

Speed and efficiency is improved by correct, timely information on goods to be received, effective use of dock levellers and handling equipment, large enough and correctly positioned marshalling areas, a quarantine area for incorrect deliveries, availability of sufficient pallets, packaging, and labels, appropriate procedures and adequately trained and motivated staff. Timing of receiving and put away should be scheduled to avoid conflict and bottlenecks with picking and despatch of goods, to ensure same day put-away and clearing of the receiving area, avoiding congestion and unrecorded or ‘lost’ products and negative knock-on effects on shipping of orders. Employees are properly trained in the safe handling, stacking, storing, picking and loading of products, (with consideration for hazardous and incompatible products), to avoid accidents, breakage, stock loss, contamination and injuries, lost productivity and profits. The warehouse layout and storage of product must take into account fast moving and high volume goods, and seasonality, with quick accessibility and identification, for minimal handling

and touches, and least distance from storage location to staging area. Picking slip information layouts need to be clear and easy to read to identify what quantity of which stock items and stock keeping units must be picked, for fast and accurate picking. Quality control procedures include picking and loading verification, assisted by scanning devices and physical checks, to prevent incorrect goods being shipped (Collins, 2008; Hansen Harps, 2005; De Villiers, Nieman and Niemann, 2010).

Johnson and McGinnis (2011) noted that because warehouse management have little control of the inventory throughputs and timing of inventory into and out of the warehouse, and the warehouse does not generate revenue, performance assessment will be done on the basis of capacity usage for volumes moved and contribution to overall cost and speed of the logistics operations. Assessments will look at identifying the optimal design for the greatest output of benefits with minimal resource usage, while taking into account the dynamic nature of the environment and those factors outside of the control of the warehouse manager. Rafele (2004) referred to indicators related to “company effectiveness and efficiency” and further linked to financial indicators that affect logistics performance and influence future investment decisions. Recommended assessment includes tangibles, reliability, responsiveness, courtesy, trust and knowledge of employees, and empathy conveyed in specific attention to customers. Specific standards and important aspects of warehouse performance to measure are space utilisation, productivity (number of items moved), accuracy (correct and complete order fulfilment), cycle or turnaround time, inventory shrinkage rates, document and information flows, and impact on customer service perception through on-time, complete and error free distribution, with flexibility (Rafele 2004; Collins, 2008; Christopher, 2011).

2.6.1.3 Best practices for transport and delivery services

De Villiers, Nieman and Niemann (2010) defined transportation as the geographic movement of goods to provide time and place utility, which can constitute a considerable part of the final total cost of goods delivered to customers, affecting the competitiveness of the company. Transport and delivery management requires, planning, coordination and control of goods and information for

continuous flow through the supply chain, with consideration for costs incurred when managing customer service levels. Companies will seek to improve efficient performance of this function with minimum resources utilised for maximum outputs. Road transport is the dominant mode of transport used in South Africa, providing a more efficient and flexible point to point delivery system than rail or air (De Villiers, Nieman and Niemann, 2010).

Poirier (2005) noted that the flow of information within a business network is critical to the physical movement of goods and the lack of vital data can “bring the whole system to its knees”. Without the necessary information on demand forecasts, procurement coordination, customer order management, correct order entry, and systems controls for eliminating mistakes, accurate planning and transport management for effective load utilisation and use of transport capacity is hampered and transport costs increase. Whereas, reliable supply and demand forecasts, transactional information and advanced shipping notification improve management of inbound and outbound transport, on-time customer deliveries and delivery cycle time. Load utilisation can be maximised with better route planning and filled return loads. This concept was further confirmed in empirical studies in the United Kingdom, which were mirrored in phase two of the study in South Africa, as illustrated in figure 2.10 (De Swardt, Potter, Robinson, and Sanchez-Rodrigues, 2011).

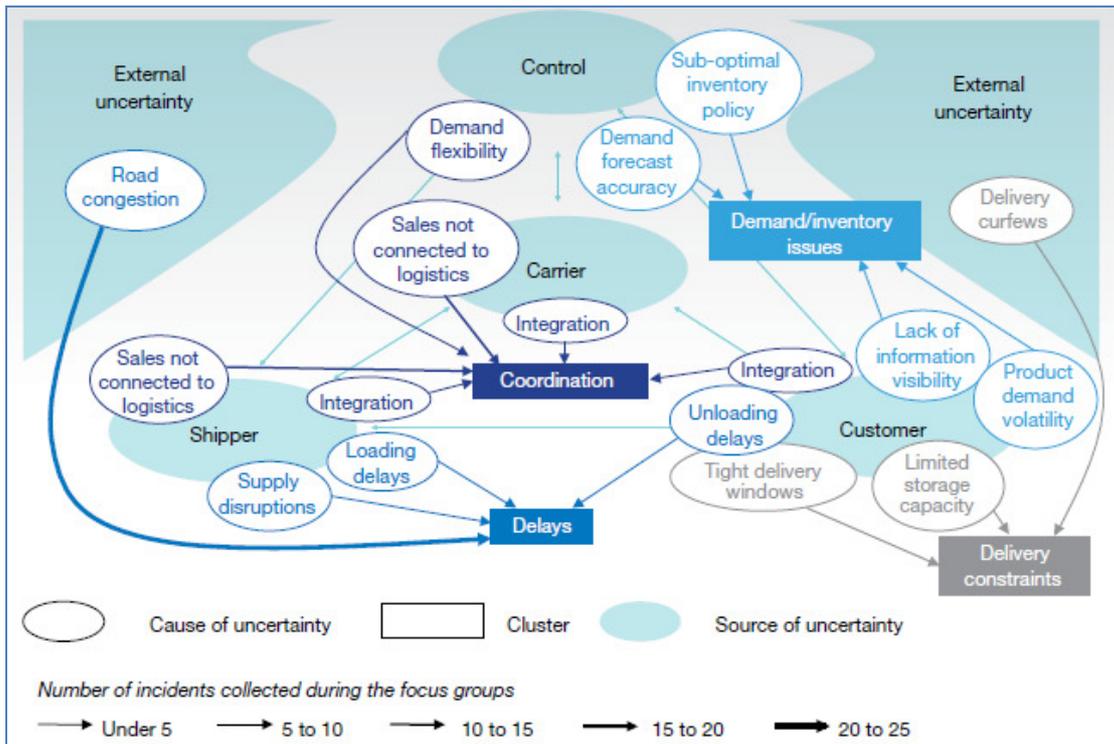


Figure 2.10 “Transport-focused uncertainty model, a mirror image for the contexts in South Africa and the United Kingdom”

Source: Sanchez-Rodrigues et al (2010) cited in De Swardt, Potter, Robinson, and Sanchez-Rodrigues (2011).

Figure 2.10, illustrates the added complexities introduced into the transport model with the increase of uncertainty due to inaccurate demand forecasts, lack of coordination and information, and delivery constraints, creating inefficiencies in a company’s transport system. The critical consequences of uncertainty are extended distances travelled, higher energy consumption and impact on the environment, and time delays experienced. This burdens the company operationally and economically and causes a higher overall landed cost of goods. The “Extra Distance Tool” evaluates distance and time that should have been incurred as opposed to that actually incurred due to: “lack of timely information on volumes to be moved, unexpected delays at loading or unloading points, operational failures in the distribution network, and congestion incurred en-route that could have been foreseen, to measure non-value adding time or distance, understand root causes and implement accurate and sustainable information, monitoring and maintenance processes for performance improvements” De Swardt, Potter, Robinson, and Sanchez-Rodrigues, (2011, p.45).

It was reported that case studies of two Gauteng distribution networks, showed that this tool can be utilised for better coordination between internal and external stakeholders. Measurement and control of causes of extra time and distance result in improved volume movement forecasting, information flows and planning, improved monthly vehicle utilisation plans for daily deliveries, earlier, more accurate picking and loading times and improved inbound offloading and outbound loading of trucks at the warehouse, avoidance of unplanned additional trips to customers and reduced waiting time at customers, effectively reducing additional distance, time, resource utilisation and cost and improving customer service (De Swardt, Potter, Robinson, and Sanchez-Rodrigues, 2011).

Engel and Roofsb-Broihan in Budde et al (2006) noted that demand for safe and environmentally friendly transport of chemicals, the risks in transporting hazardous chemicals over distances, and the fact that customers hold smaller quantities of chemical inventory, requires successful distributors to optimise skills and resource usage for cost effective, timely and frequent deliveries. However, Swanepoel, cited in Ittmann and King (2011, p.5) stated that “Inadequate rail capacity, bad road quality, skills shortages and insufficient collaboration plague South Africa’s logistics services and result in high total cost of logistics”. Steyn and Bean (2011, pp.30-35) further reported that South Africa’s “deteriorating road quality leads to drastic increases in vehicle maintenance and repair costs, resulting in sizeable increases in company logistics costs”, and that “trucks travelling on bad roads ultimately experience increased vibrations, which can lead to damaged cargo”. This requires careful management of load position and balancing in the truck, with the most damage to goods experienced in the “uppermost location to the back of the truck’s trailer”. The flipside to the lack of maintenance is the high incidence of stoppages on some of South Africa’s main routes due to road maintenance works, which emphasises the need to be informed of the location of road works to plan routes accordingly and prevent extra time and distance (Steyn and Bean, 2011, pp.30-35). Barloworld Logistics (2012) notes this high cost, plus recent imposition of tolling and carbon taxes as a serious constraint in all industries and calls for companies to continuously analyse their transport strategies to find innovative and collaborative cost-efficient solutions for moving goods to customers.

According to McKinnon (2010) effective load utilisation reduces the cost of operating a fleet. It takes into account weight, space and product compatibility factors in packaging, stacking and loading to maximise load density per trip and avoids trucks running empty. Through coordination of procurement and sales, backhauls from suppliers benefit procurement with factory gate prices. Shared capacity with customers and suppliers mean that logistics managers arrange shared delivery routes or return trip pickups. Plus proper planning and timely information for customer returns results in back loading, thus reducing per kilometre and per kilogram costs and avoiding empty running of trucks. To this end “the use of integrated vehicle tracking, GPS navigation, communication technology and telematics, and ‘computerised vehicle routing and scheduling’ systems optimise vehicle usage through planning, measuring and adjusting route plans, distance travelled, load capacity and consolidation, driving time and costs”, introducing real time monitoring and flexibility. It is necessary to collaborate vertically and horizontally, internally and with trading partners, to overcome the constraints of: “demand fluctuation, lack of knowledge of backloading and load consolidation opportunities, health and safety regulations, vehicle size and weight restrictions, unreliable delivery schedules, just in time delivery, goods handling requirements, limited capacity of facilities, incompatibility of trucks and products and poor coordination of purchasing, sales and logistics” (McKinnon, 2010, pp.285-301).

The Descartes Systems Group Inc (2012) note that best practice approaches to managing the last mile to meet customer demand in a competitive environment include:

- 1) “putting a plan in place for maximising capital asset and manpower usage,
- 2) implementing integrated technology for advanced functionality and reporting that fits the business needs,
- 3) analysing and assessing information and reports to assess delivery strategy alignment to customers,
- 4) establishing engineered standard operating procedures around loads, routes and service times, with realistic measurement criteria to assess performance,
- 5) understanding both qualitative and quantitative constraints, with technology solutions used for planning ensuring flexibility in the delivery process,

- 6) management of drivers as well as vehicles, with benchmarks and measurement of actual performance;
- 7) planning around the customer allowing for receiving requirements and schedules, and capacity available,
- 8) measuring customer performance, dock delays and receiving problems to work with the customer to eliminate them,
- 9) expecting the unexpected, such as weather and traffic issues to establish contingencies to adjust accordingly, and
- 10) measuring performance against the plan by using analysis tools and information to improve planning, deployment and management of delivery resources” The Descartes Systems Group Inc (2012).

2.7 Human resources management and training for efficient logistics

It is insufficient to simply establish and implement global best practices in chemical organisations without institutionalising them by setting clear standards, preventing deviation and ensuring the necessary training to increase knowledge and capabilities for on-going improvements. Continuous Improvement Programs (CIP's) require structured and planned training programs which are tailored to the needs of the specific organisation, with the emphasis on spreading skills and knowledge and building functional and area experts to improve the organisation's core competencies and competitive edge (Nickel, 2006).

As has been seen in the discussions so far, in the new economy skill and knowledge are now more important assets than the physical assets of a company (Hayes, 2004). Knowledge and capabilities 'embedded in the organisation's practices are not traded and are difficult to imitate. Now operations call for a different perspective on skills with a need for more knowledgeable and capable workers. However, the more skilled workers are now more mobile between companies (Mentzer and Williams, 2001; Hayes, 2004). Furthermore, Hofmann and Frankemolle (2006) and Valk (2011) noted that companies in the chemical industry are regularly regarded as unattractive as employers by skilled and desired workers, making it difficult to attract the appropriately qualified talent even in economic and employment downturns. It is even difficult to find skilled truck drivers with necessary hazardous goods training. Companies find that ineffective

employees hang on to their jobs due to economic conditions. This highlights the need for effective human resources management, recruitment, training and skills development, talent management and retention strategies, to keep and attract the top talent and set a company apart from its competition. For distributors, skilled and knowledgeable purchasing, logistics and sales employees, developing strong, long-term end-to-end supply chain relationships with excellent technical knowledge is a key to success and may require some structural changes (Hofmann and Frankemolle, 2006; Halley and Guilhon, 1997; Valk, 2011). Global chemical distributor Hubbard-Hall was reported to be spending more on being an attractive employer, focusing more on people, employee training and identifying necessary skill sets than on infrastructure and trucks to “help its workforce contend with a rapidly changing business environment” (Valk, 2011, p.21).

Training requires focus so that employees at all levels in the organisation have confidence that they possess the necessary skills to achieve what is required of them. Peko and Ahmed (2011) asserted that, “A company must develop a strategic approach that not only maintains a low cost focus but affords the opportunity to differentiate an undifferentiated commodity product to become a market leader by developing a core competence in logistics; a notion of core competencies as the root of competitive advantage”. Transference of skills and knowledge across and between the organisation’s value chain activities, especially where they are advanced and internally developed can be a substantial foundation for competitive advantage. Attention to skills development also gives employees the sense of being valued by the company and boosts their morale. This is necessary to sustain improvements which are seen in the improved productivity and effectiveness of the organisation. A change in leadership style may be required to sustain improved operational performance, with regular performance management, and clearly stated key performance indicators that are measured and communication down to the shop floor. Management will be more hands on, in change management to realise sustained changed behaviour, and in ensuring effective delegation of tasks and responsibilities, identification and trouble shooting of problem areas in cross functional teams and encouraging employees to ask for help and further training in order to meet the operational objectives (Porter, 1985; Halley and Guilhon, 1997; Birnbaum, 2006). According to Gattorna (2010b, p.131)

the “capability levers” required for shaping organisations for effective logistics operations include the “organisational structure, reporting lines and decision making powers, people positioned effectively in the organisation’s structures according to their natural strengths, job designs, identified key performance areas and performance measurements with matching incentive schemes and motivation, development and training programs, recruitment from external sources with both the required technical skills and appropriate mind-set to support planned initiatives, role modelling, and leadership style of top management team”. Halley and Guilhon (1997, p.491) asserted that “Strategy preparation lies first and foremost in human resources management based on the development of general logistics competencies and core competencies”.

Chemical companies in the East are catching up to their western counterparts in organisational performance through development of core skills and capabilities, with alliances and joint ventures and internal learning programs, while external expertise has been identified as a further source of ‘functional knowledge and experience’ for success in chemical industry operations (de Mahieu, Günther, and Riese, 2006). Productivity management with an improved customer service mind-set requires training coupled with effective incentive schemes for effective and sustained best practices and ultimate customer service and productivity. Bringing in seasoned best practice talent from outside can strengthen the company’s infrastructure, while continuous reassessment of business demands against the existing talent pool capabilities allows for adjustment and training to meet the challenges and allows the company to build on existing skills and advantages (de Mahieu, Günther, and Riese, 2006; Ferrara Consulting Group, 2006; Hofmann and Frankemolle, 2006; Rasch, 2006; Hayes, 2008).

Straube, Nagel and Rief (2010) stressed that the best companies, in networked environments, using a combination of internal and outsourced operations, cooperated with service providers and customers. Using assessment procedures and regular benchmarking they assess their operations and skills and use the insights gained to identify “best practices and effective courses of action for further optimisation” of their operations (Straube, Nagel and Rief, 2010). In the South African context, logistics and transport were noted as scarce skills in the

Department of Labour scarce skills list, showing deterioration in this area, which must have had a major negative impact on the competitiveness of the economy at large. It noted that the bulk of the skills shortages were at the functional and operational levels and recommended that companies take advantage of government basic education, and further education and training initiatives and collaborate with other companies, government and educational institutions for skills transference and “work-integrated learning, apprenticeships, learnerships and internships” with a combination of tertiary education course work, with structured learning at work, to improve the work place skills of employees (Kilbourn and Wessels, 2011). Then in a recent survey the difficulty of finding skilled employees is further highlighted as illustrated in figure 2.11., reflecting on the top five constraints experienced by companies.

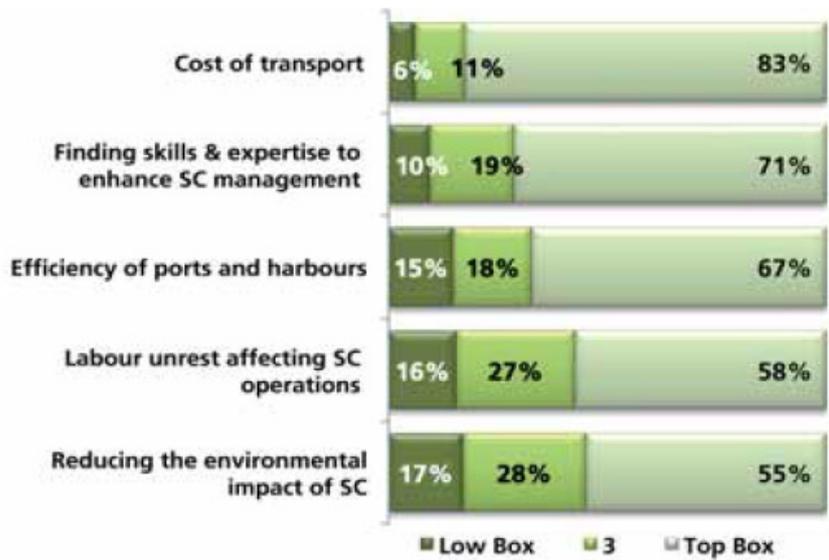


Figure 2.11 Top 5 constraints to supply chain
Source: Barloworld Logistics, 2012, p.6

As illustrated in figure 2.11 and the following figure 2.12 finding the required skills and expertise is still a major issue, being rated second most important constraint to supply chains in figure 2.11, and a serious challenge to organisations. The question is asked whether companies are establishing appropriate partnerships with the right organisations to acquire the required skills and expertise. The labour unrest featuring third in the survey results re-enforces the previously discussed need for effective human resource management. It is however asserted that

government intervention is also required in managing the expectations of the grass roots labour force and making quality education programs accessible to them (Kilbourn and Wessels, 2011; Barloworld Logistics, 2012).

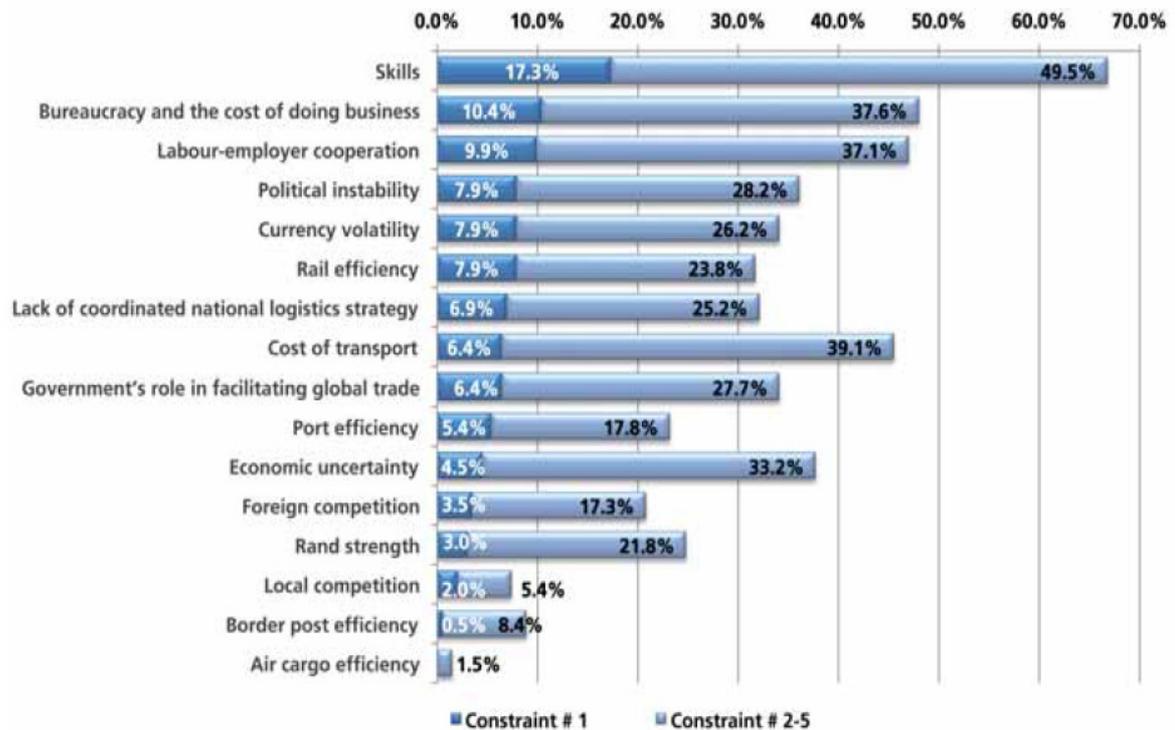


Figure 2.12 Constraints on competitiveness
Source: Barloworld Logistics, 2012, p.10

In figure 2.12 companies surveyed on constraints on competitiveness regarded the “skills vacuum” as the most important constraint, with labour-employer cooperation third, indicating the respondents’ awareness that the country’s longer-term competitive advantage relies not only on infrastructure and best practice, but on people and good human relations to implement and achieve the organisations competitive objectives (Barloworld Logistics, 2012). Yet it is noted that the “South African Chemical Sector Report On Skills Development and the Government’s New Economic Policy Priorities” study commissioned by the department of labour, focused on the technical skills required for production and innovation and excluded the skills required for logistics operations, warehousing, and distribution in the chemicals industry (Van Zyl, 2008). It is therefore relevant to note where the 2011 SupplyChainForesight survey identified that companies were sourcing their training from as indicated in figure 2.13:

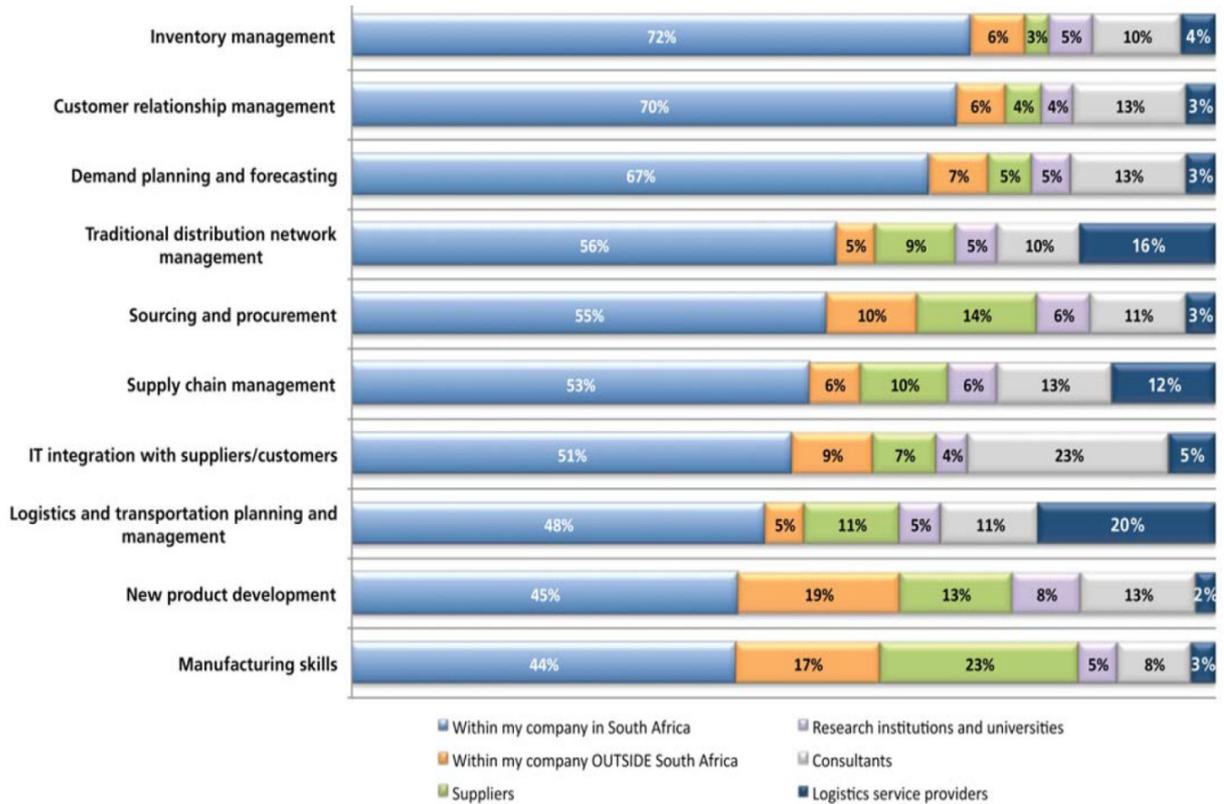


Figure 2.13 Where skills are sourced
 Source: Barloworld Logistics, 2011, p.17

Figure 2.13 illustrates the initiatives of companies to close the skills gap with the majority of the skills development taking place within the companies, with the benefit of network links to other companies, like suppliers and consultants for external skills transfer discussed earlier, clearly illustrated here. The methods by which skills are developed within companies is illustrated in Figure 2.14

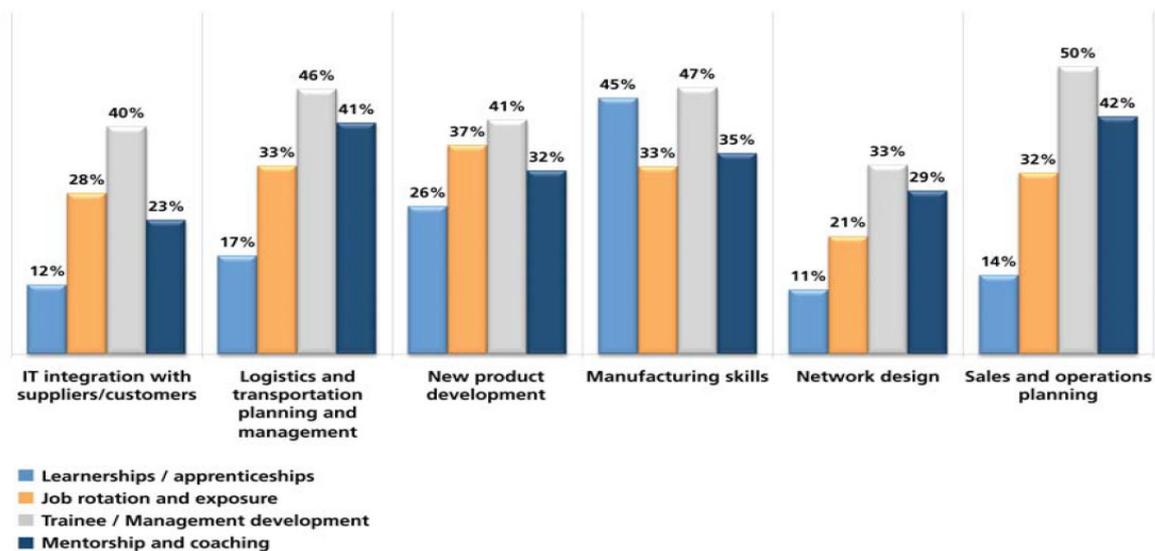
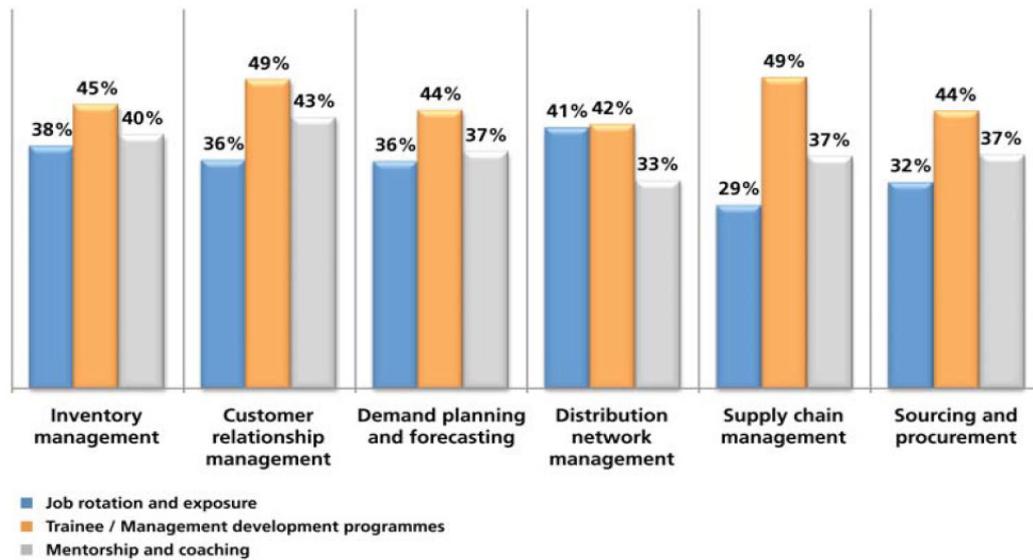


Figure 2.14 Growing skills within companies.
Source: Barloworld Logistics, 2011, p.18

Figure 2.14 also illustrated the importance of the human resource and training aspects referred to earlier, in that the use of job design, job rotation, building on existing knowledge and skills transfer, with mentoring and coaching, learnerships, apprenticeships and development programs are used to develop skills in a wide range of value chain activities.

Although the aspects of training, human resource and performance management are important Birnbaum (2006, p.232) highlighted the fact that in the past improvement programs failed in the chemical industry due to a unilateral or

imbalanced focus on systems, performance management or human resources management. For chemical companies to implement, execute and sustain improvement initiatives for optimal operating efficiency the “Three elements of Real Transformation” seen in Figure 2.15 must be viewed together holistically, with each being equally crucial to success.

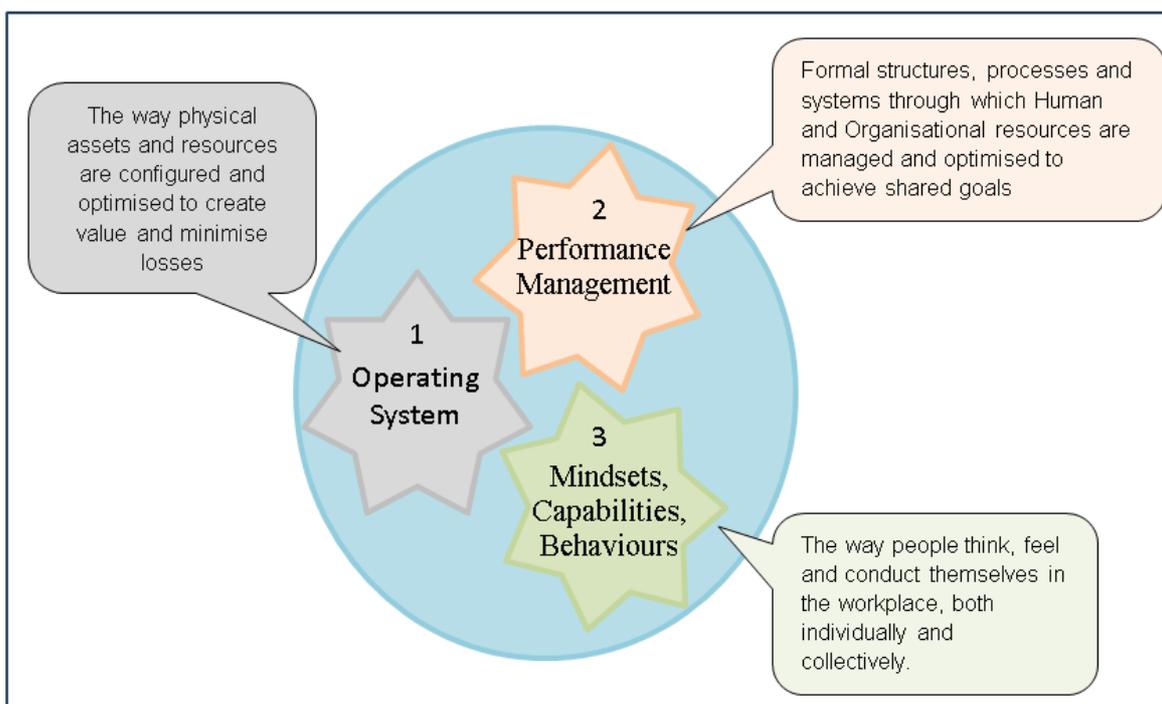


Figure 2.15 “Three elements of real transformation”
Source: Adapted from McKinsey (nd.) cited in Birnbaum (2006, p.231).

Due to their impact on each other, falling down in any one of the elements in Figure 2.15 would result in failure in the other elements of the organisation. Unilateral focus must be avoided and the three elements must be managed together as the organisation works towards understanding its core processes and identifying the best practices and skills required, in the context of the chemical industry and the blueprint for where the organisation is heading (Birnbaum, 2006).

2.8 Conclusion

This chapter has given a brief background to the chemical industry and some reference to the global distribution sector. The majority of the literature found in this regard related to the chemical industry in Canada, America, the United Kingdom, Europe and the East.

The literature also explored the concepts of business operations management, logistics and logistics operations management. This laid a foundation for understanding the importance of logistics to customer service, and the information systems that may enable efficiency in logistics operations. It was followed by discussion of the relevance of best practices to business operations and investigation of best practices relating to time compression, warehouse management, and transport and delivery services. The investigation into improvements in logistics efficiency was concluded with a review of literature relating to the human resource management and training aspects that may be relevant to efficient logistics operations. Based on the foregoing literature review it has become evident that there is a lack of material related to the efficiency of logistics in the chemical distribution sector in South Africa. The next chapter will explain the research methodology proposed for the completion of this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The literature reviewed in chapter 2 identified the existing ideas, trends and themes related to logistics in the international chemical industry and, in some cases, to the South African logistics sector. It reviewed journals and articles, books, studies, presentations and seminar reports, which included experiences, knowledge, theories and findings from expert authors and participants, academics and researchers. Although there were some well-developed theories the majority of this related to the business environments outside of South Africa and little data could be found relating specifically to the South African chemical raw material distribution sector. This indicated a need for research in order to understand the local context for logistics efficiency improvements for customer service in this sector.

Research is about generating a body of knowledge that is based on reliable evidence. Applied research is a form of research which looks at finding solutions to a specific problem, while also contributing to an existing body of knowledge (Lee and Lings, 2008). Business research is an organised, systematic endeavour to examine a specific set of issues that are important to management and find a solution to this business problem or opportunity. This requires the following research process: identification and definition of problems and opportunities requiring further study, information gathered, data analysed, relevant factors determined and pertinent actions decided (Cavanah, Delahaye and Sekaran, 2001). Business research tries to explain and predict phenomena that make up the constantly changing environment. It is truth seeking, gathering, analysing, interpreting and reporting information to make managers more effective (Hair, Money, Samouel and Page, 2007). Business and management research often results in a fundamental change in the way that business is practiced and managers do their work (White, 2000).

According to Badenhorst (2010) “Research is about making a claim, then putting procedures in place to provide an argument and evidence. Research methods are our ways of producing the knowledge”. White (2000) noted that research methodology is the approach used to investigate the topic and the methods are the techniques used. For a dissertation to be regarded as reliable and valid an accepted and recognised methodology should be used along with accurate methods to collect data (White, 2000, p.21).

This chapter will describe the aims and objectives of the study. The qualitative and quantitative data collection instruments are discussed, along with reasons for the choice of the instruments and their administration. Furthermore the methods for achieving accurate and reliable results from the study will be explained.

3.2 Aim and objectives of the study

3.2.1 Aims of the study

The aim of the study is to identify and understand relevant logistics best practices, technologies and human resource strategies, where required, that will assist organisations in the South African chemical distribution sector to achieve efficient logistics operations for optimal customer service and profits.

3.2.2 Objectives of the study

The overall objective of the study is to research and investigate available best practices, technologies and human resource strategies to improve logistics efficiencies for optimal customer service.

This can be broken down to the following objectives:

1. Determine if logistics best practices and technologies can be identified which will improve logistics efficiency for improved customer service in the chemical distribution sector.
2. Determine what information system technologies may enable best practice logistics and improve efficiency of logistics operations in the South African chemical distribution sector.
3. Determine what Human Resource and training aspects must be considered

3.3 Research methods and data collection

In order to understand the applicability and generalizability of the aforementioned ideas, trends and themes to the South African chemical distribution sector it was important to identify research methods and instruments for gathering the relevant information for the local business context. Permission to conduct the research within a distributor's organisation, to use relevant company data, its customer and supplier lists and the resources of the company and to approach employees and consultants for the purpose of the study was given by the Managing Director in a gatekeeper's letter.

3.3.1 Qualitative data collection

Qualitative research is explorative, discovery oriented and based on inductive reasoning, building a theory from the data collected (Hair, Money, Samouel and Page, 2007). It is helpful for understanding the various phenomena in a given situation in order to drill down for further comprehensive investigation (Sekaran and Bougie, 2010, p.104). Phenomenological research starts with the real, lived experiences of people that create the social realities of the world. Qualitative interviews and questionnaires glean their first hand experiences in a particular environment or circumstance (Lee and Lings, 2008). These instruments, describe the behaviour and interactions of individuals and processes, are less structured and use a non-mathematical process of gathering and interpreting the research. Looking at the problem from a number of approaches is a valid manner for verifying conclusions and interpretation of research. It was therefore decided to follow up a qualitative study with a quantitative survey (White, 2000, p.25).

A qualitative approach is most appropriate where little is known about a problem or previous research only partially covered the research question (Hair, Money, Samouel and Page, 2007). Given the lack of published research information it was necessary to use a qualitative instrument to gain an initial understanding of the local context for logistics efficiency improvements in the South African chemical distribution sector.

3.3.1.1 Interview schedule design

The initial design of the questionnaire was done with a view to the possibility of interviewing respondents face-to-face, hence it being referred to as the interview schedule. However, due to geographical, logistical and time constraints, and the nature of the jobs of the subjects, it was found that the respondents favoured receiving the questionnaire via email and completing them at their convenience, before returning the same via email.

For subjects to be encouraged and willing to respond to a questionnaire it needs to give sufficient guidance on completion of the questions, be relevant, brief, easy to read, aesthetically pleasing, easy to understand and answer, unambiguous, logically laid out and easy to submit (Wood, 2000; Sekaran and Bougie, 2010). The open-ended questions, informed by the literature formerly reviewed, and the previously stated research objectives, were structured and worded in such a manner as to encourage narrative and informative answers, without any constraints. It was divided into three sections relating to the three research objectives (Wood, 2008).

Consideration needed to be given to the level of respondent, simplicity and understanding and the length of the questions (Sekaran and Bougie, 2010). Therefore when the questionnaire was sent to subjects in higher positions in organisations, less additional information was given and the questions were short and to the point. When it was sent to less sophisticated subjects a brief paragraph explaining the concepts relating to best practices, skill sets, core capabilities and human resource strategies was included and additional words were added within the questions for clarity of meaning of the question.

If any clarity was sought on any of the questions, or further thought given by respondents after the submission of the responses, this was communicated by follow up email correspondence.

3.3.1.2 Administration of the interview schedule

The interview schedule containing the qualitative questions was accompanied by the ethical clearance declaration, a brief description of the objectives of the study

and the research questions which the study aims to resolve. After discussion or correspondence with the subjects this was disseminated via email to them. Follow up emails were sent, and phone calls were made to encourage participation when subjects had failed to respond. Employees and managers of the distribution organisation and associates in the industry assisted in approaching relevant subjects to request their participation in the qualitative research.

3.3.2 Quantitative data collection

A literature review creates a conceptual framework with the summarisation of common concepts, ideas and themes that guide the researcher in qualitative research and then in the collection of representative data, through a structured questionnaire, to draw an objective conclusion in the given situation (Hair, Money, Samouel and Page, 2007). Quantitative research is a scientific and objective approach, using mathematical and statistical methods of analysing facts and observable phenomena. “Deductive reasoning is used to describe, test and explain relationships and deduce laws from the quantitative data analysis”. From the statistical results of the numerical analysis it can be established if the proposed solutions are generalizable to the studied population. It provides management with an “objective guide to professional practice” (White, 2000, pp. 46-47). This statistical evidence also helps to refute the accusations of anecdotal evidence from qualitative research and quotes reported from literature reviews (Lee and Lings, 2008).

Descriptive studies further outline the profile and give an understanding of common practices and changes in an organisation or industry. The quantitative data, in terms of frequencies, or mean and standard deviations, as achieved from a structured questionnaire which allows for numerical analysis, are necessary for these descriptive research projects (Cavanah, Delahaye and Sekaran, 2001, pp.110-111). A number of practices and theories in business operations, logistics, technology usage, and skills development were identified from the literature review. The quantitative questionnaire was chosen as an instrument via which to ascertain the frequency, rating and acceptability of their application in the sector, to gather answers to the research questions and test level of agreement to the identified concepts and theories.

3.3.2.1 Administration of the quantitative questionnaire

The questionnaire was constructed in a word document with the necessary ethical declaration and opportunity to accept the ethical terms of participation, followed by relevant questions. For the majority of the recipients the questionnaires were imbedded in an email and disseminated to the target population via a bulk email distribution program. The balance was distributed via direct email correspondence with the subjects, either as attachments or in the body of the email, or distributed to the subjects by the employees, directors and associates of the distribution organisation and the researcher.

Although this dissemination method was initially regarded as a fast and efficient way of disseminating a high volume of questionnaires over a vast geographical area (White, 2000) and the email surveys are regarded as more popular, inexpensive to distribute, quicker to complete and easier to return and can produce high quality data (Hair, Money, Samouel and Page, 2007) the success rate of delivery could not be warranted. The main disadvantage of the bulk mail distribution method was the high failure rate of the email delivery system due to invalid email addresses and blocked email formats. Hence the final distribution list was estimated at a few hundred recipients.

3.3.2.2 The quantitative questionnaire

The overriding guideline for questions to be included in the questionnaire was the stated objectives and underlying research questions for the project (Hair, Money, Samouel and Page, 2007). The first consideration in the design of the questionnaire was that it would be used for inferential statistical analysis (White, 2000). To this extent the questions were structured for aggregation and quantitative statistical analysis through the SPSS (Statistical Package for the Social Sciences) software program.

The five point Likert Interval scale was used to identify level of agreement with a number of questions and statements. Ranking scales were used to understand the importance imputed to the driving forces for logistics efficiency improvements and elements of customer service. Then nominal scales were used to identify the frequency of application of identified management practices, computer

technologies and skills development strategies. Thereafter rating scales were used to establish perceptions of quality of their administration, effectiveness, ease of use, accuracy, cost savings, cost of implementation, and reliability (Cavanah, Delahaye and Sekaran, 2001).

3.4 Pre-testing and validation of the questionnaires as research instruments

The initial design and content of the questions were assessed for alignment to the research objectives and questions by a research examiner at the Graduate School of Business and Leadership of the University of Kwa Zulu Natal and the research supervisor. Prior to the mass distribution the research instruments were distributed to four individuals; the recently retired managing director of a major distributor, a senior executive of a top supplier of a distributor, a regional executive of a distributor and a senior manager of a customer of a distributor. One respondent did not complete the test questionnaire due to a major relocation project. The other three completed the instruments without any concerns being raised.

3.5 Sampling

Sekaran and Bougie (2010, pp.262-263) describe a population as the “entire group of people or things that the researcher wishes to investigate”, the sample as “a subset of the population comprising some members selected from it”, an element as “a single member of the population” and a subject as “a single member of the sample. Therefore if a factory population consists of 1000 workers, 200 members drawn from it form the sample and a single worker would constitute an element, while a single member of the subset of 200 constitutes a subject”. In order for the research statistics, (mean, deviation and variance) of the sample to be close to, and hence generalizable to, the population the sample must be sufficiently large enough and chosen in such a way as to be representative of the population (Sekaran and Bougie, 2010).

The research project title defined the population as the chemical raw material distribution sector of South Africa. Although the chemical industry accounted for approximately 5% of GDP and 25% of manufacturing output in 2008 (Van Zyl, 2008) there are only four major chemical raw material distributors and a small number of minor distributors in the sector. The complexity in defining the

population comes from the fact that chemical raw material distributors import and distribute from a number of foreign and local manufacturers of raw materials and sell into a number of different industry sectors, such as food, textile, cleaning and household materials and personal care products, who sometimes process and distribute further downstream. For the purpose of the study the sample frame was defined mainly as the national employee, customer and supplier lists of one of the major chemical raw material distributors. This included elements in various levels and positions in the different organisation groups nationally. The elements that did not relate to the objectives of the study were eliminated from the lists to establish a possible representative sample. Elements identified in the greater population via internet research were added to the sample. Further to this employees and directors of the distributor and associates in the industry were approached and requested to identify further subjects who would add to the representivity of the sample.

Qualitative sampling relies on an entirely different construct to that of quantitative sampling. The nature of 'generating' data and gaining clarity of phenomena in qualitative research lends itself to a purposeful rather than a random selection. Purposive sampling of a small number of respondents (elements) from the population, from which rich information, that stands up to an external validity test, is more appropriate (Lee and Lings, 2008, pp.212-213). Cavanah, Delahaye and Sekaran (2001) noted that in qualitative research realities and perceptions of the participants are multiple and subjective from their different perspectives in the context of their setting. Sekaran and Bougie (2010) asserted that in the exploratory phase of getting to grips with the "phenomena of interest" purposive judgement sampling allows for the selection of a limited number of specific subjects who are best placed to provide the rich information. Due to the fact that efficient logistics for customer service would impact all levels of the organisation in different departments, the initial qualitative questionnaire was distributed to a selected number of subjects, fulfilling a number of different job roles within a national chemical distribution organisation, a few subjects working at different chemical raw materials suppliers and a few subjects working at chemical raw material customers.

Dissemination of the quantitative questionnaire needed to be to a sufficiently representative sample that would supply relevant and accurate information for rigor and validity of the research (Lee and Lings, 2008). As a result of distributing the questionnaire to all of the elements on the compiled list a method of nonprobability simple random sampling was employed, where any element within the population had an equal opportunity of being selected as a subject for the research (Sekaran and Bougie, 2010).

3.6 Data analysis

The quantitative data that is collected will be imported into an excel worksheet for consolidation and collating into a standardised numerical database of variables for statistical and mathematical analysis. Various formulas are included in the data tables to test validity, goodness and completeness of the data in the submitted responses. A validity instrument of Cronbach Alpha will be used in the SPSS software for reliability and consistency testing (Cavanah, Delahaye and Sekaran, 2001). Analysis will be done by means of categorisation, diagrams, tables, figures and numerical description, with methods depending on whether data is nominal, ordinal, interval or ratio in type and based on meaning derived from the numbers. Trends, patterns and correlations between variables will be identified and tested (White, 2000). The analysis will be guided and informed by the literature reviews and research questions. Descriptive statistics will identify frequencies, measures of central tendency, and dispersions in the quantitative data which will assist to profile the elements and describe the sample using bar and line charts and tables for illustration (Sekaran and Bougie, 2010). Inferential statistics are reflected through the correlations between variables (Cavanah, Delahaye and Sekaran, 2001). The analysis of the qualitative data will be by means of descriptions and identified concepts and commonalities or trends apparent in the data (White, 2000).

3.7 Conclusion

This chapter introduced the concepts of research methodology and in particular, business research. It discussed the aims and objectives of the study. The data collection methods via qualitative and quantitative research instruments and the reason for their selection, design, administration and pre-testing were explained.

The population, framework and sampling methods as well as the intended data analysis methods were discussed. By adhering to accepted research methods, reliable and accurate data was obtained and appropriately analysed. The next chapter will present the data and discuss the analysis thereof.

CHAPTER FOUR

PRESENTATION AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter is a combination of chapter four and five, as per the Graduate School of Business Dissertation Guideline for 2012. In this chapter the results extracted from the collected data are presented using graphs and tables, inferential and descriptive statistics (Chapter four). The results are also discussed and explained in conjunction with the information obtained from the literature reviewed in chapter two in line with the stated objectives of the study (Chapter five). It will be seen from the data presented and the discussions how the data has supported the objectives for the identification of best practices and technologies, information systems and skills development methods for improvement in logistics efficiencies and customer service.

4.2. Objectives to be achieved from data

The stated objectives were to:

1. Determine if logistics best practices and technologies can be identified which will improve logistics efficiency for improved customer service in the chemical distribution sector,
2. Determine what information system technologies may enable best practice logistics and improve efficiency of logistics operations in the South African chemical distribution sector,
3. Determine what Human Resource and training aspects must be considered.

4.3. Population Samples

4.3.1. Qualitative data population sample

The sample was defined by the nature and objectives of the study as a sub-set of people in the chemical industry relating to chemical distributors. The qualitative sample was a purposefully selected group of elements or people from the subset.

These elements are referred to as subjects. The sample included 3 subjects from different suppliers, 26 subjects from three distributors and 4 subjects from different customers which gave a total sample size of 33.

4.3.2 Quantitative data population sample

For the majority of the recipients the quantitative questionnaires were imbedded in an email and disseminated to the target population of 1300 via a bulk email distribution program. Although this dissemination method was initially regarded as a fast and efficient way of disseminating the questionnaires over a vast geographical area the success rate of the delivery could not be guaranteed. Due to the high failure rate of the email delivery system resulting from invalid email addresses and blocked email formats the final distribution list was estimated at a few hundred recipients.

From this target population of 1300 and the quantitative data collected the final sample population from the various organisations consisted of 59 subjects from 53 customer organisations, 45 subjects from 22 distributor organisations and 17 subjects from 16 supplier organisations; a total sample size of 121 subjects from these organisations. It is of importance to note that the four top tier distributors are well represented in the sample, as well as manufacturers of raw materials regarded as key suppliers in the sector. The data collection revealed that there were a higher number of smaller distributors than initially anticipated at the start of the study. The customer mix ranged from South African based large international corporate clients of distributors, to medium sized enterprises, to small and micro enterprises. This sample mix produced a high level of confidence regarding the generalizability of the results of the data analysis to the total population of the chemical distribution sector in South Africa.

The richness of the data was regarded as high due to the calibre of respondents and diversity of the roles of the subjects in their organisations. At least 60 subjects represented Top and Executive management and Middle management and 45 subjects were involved in procurement, operations and logistics. Further subjects were involved in sales, customer relationship management, customer account management, finance, commerce, administration and production.

4.4 Quantitative data reliability testing

The consolidated quantitative data tables were tested for reliability and consistency in SPSS software and the Cronbach alpha test revealed a reliability coefficient of .780. This test was checked and confirmed by the research supervisor.

The data collected was tested using inferential and descriptive statistics. It was also more suitable to the testing of correlations using excel statistical formulas, measuring the strength, direction and significance of relationships between variables in the data. Further tests involved central tendency and standard deviation for consistency of the data and identification of outliers (Sekaran and Bougie, 2010).

Fitness for use tests ensured that only clean data was used and doubtful or 'dirty' data (incorrectly answered questions or inconsistencies in responses to questions) was excluded, ensuring a more accurate reflection of distribution in the data (Lind, Marchal & Wathen 2010). Where subjects added 'other technologies' in Q17 that were either not technology at all (manual/ visual tracking, manual inventory) or confused the technologies with information systems (Syspro is ERP, vehicle tracking is part of transport management systems) these were excluded from the data. Where subjects mentioned the technology under 'other' when it was already a listed technology (automated picking) their responses were moved to the listed technology. Similarly in Q18 where subjects showed Syspro or Pastel accounting under 'other' instead of ERP or accounting systems their responses were moved. While it is understood that smaller companies use excel spread sheets where information systems are not implemented this was excluded from 'other' as it is not an information system. Completeness and cleanliness of data was manually checked and cross references between scores of implementation and rating was done via formulas in excel. Quality of individual questionnaires was measured by an overall rating score for completeness, responsiveness and consistency. None of the questionnaires were excluded overall for poor responsiveness or incompleteness. It was checked by correspondence with some subjects and accepted that where there was a low score for responsiveness in implementation this was because the reality reflected the information from the literature review,

noting that the chemical distribution sector is unsophisticated and slow to implement technology (Closs, Mollenkopf and Keller, 2005).

It initially appeared that inconsistency between number of tools implemented and number of tools rated in the different questions would reveal inconsistency and skewing in data points. After further investigation with subjects it became apparent that subjects correctly ticked the boxes for items implemented in their current organisation, but rated the items with which they were familiar for accuracy, cost, reliability, ease of use and so forth from past and current experience, meaning that they often rated items not implemented in their current organisation. The researcher and supervisor therefore agreed that this was reliable data that added value to establishing the relevance, applicability and generalizability of the identified technologies and practices to the South African chemical raw material distribution sector.

For the Ranking questions 14 and 15, where the researcher was unable to get subjects to correct their error when they rated instead of ranked the elements, these responses were eliminated from the data to avoid skewed statistics (Sekaran and Bougie 2010). 16 of 121 responses were excluded from Q14 and 18 out of 121 responses were excluded from Q15 as a result.

4.5 Qualitative and quantitative data analysis supporting the objectives

This section will present the qualitative and quantitative data collected and discuss its relevance and correlation to the literature reviewed. Further concepts identified in the qualitative data and any incongruence with the quantitative data as well as literature will be explored. The qualitative data collected closely resembles a number of issues identified in and solutions and best practices recorded from the literature reviewed.

The quantitative data measured the level of agreement with certain concepts on a 5 point Likert scale. The first 13 questions were grouped in a table of statements to which subjects were requested to indicate their level of agreement. For the purpose of statistical analysis the points of the Likert scale were scored from 1 – 5 and a mean score for level of agreement per category of subject was established.

Then ranking scales were used to determine level of importance given to certain elements by the sample population. Current frequency of implementation was tested and rating scales were used to identify perceptions of cost, effectiveness, accuracy, reliability and ease of use of various management tools, technologies and training and development tools. In addition the subjects were asked to respond with other forms of data such as yes no answers and other quantitative data. In this section inferences are drawn about the population parameters based on the sample data statistics (Keller, 2009). Trends, patterns and variables are discussed and interpreted through deductive reasoning (White, 2000) to profile the chemical distribution sector in answer to the research questions by identifying common practices and views (Cavanah, Delahaye and Sekaran, 2001). The tables and graphs represent the aggregate overall score for the sample population and the aggregate score per category of subject to assist in the descriptive and inferential analysis. These presented results are discussed in conjunction with the qualitative data and literature reviewed. It will be seen how the collected data supports the applicability and generalizability of the concepts and tools found in the literature to the South African chemical distribution sector.

4.5.1 Objective 1:

Determine if logistics best practices and technologies can be identified which will improve logistics efficiency for improved customer service

Qualitative question 1.1: What do customers need from distributors?

In order to gain an understanding of what logistics efficiency for improved customer service would entail it was important to ascertain what it is that customers want from the chemical raw material distributor.

The overriding themes that repeated themselves across the open-ended responses of the thirty three survey subjects are consolidated and summarised here. They noted that customers require:

- a) On time deliveries – just in time, prompt, at the right time, shortest lead times (20/33)
- b) Competitive pricing (20/33)

- c) Service excellence – helpful, friendly, good, correct, problem free (14/33)
- d) Quality – fit for purpose, consistent (13/33)
- e) Stock Availability – consistency of supply (9/33)
- f) Reliability – service, staff, product, resources (7/33)
- g) Right product – to meet customer needs, per specification (5/33)
- h) Efficiency – from staff in all departments, and deliveries (4/33)
- i) Complete orders (4/33)
- j) Problems solved quickly – back up service, get them out of trouble (4/33)
- k) Good communication – feedback, information, timely, frequent (4/33)
- l) Products in good condition, good packaging, without damage (3/33)
- m) Knowledgeable sales force – about products, customers, technical (3/33)
- n) Broad product range (3/33)
- o) Technical advice – technical backup (3/33)

Further needs noted that were stated less than 3 times:

- a) Adherence to safety standards (2/33)
- b) Reputation of the supplier (2/33)
- c) Correct documentation – certificates of analysis, invoice, delivery note, hazardous declarations (2/33)
- d) Knowledge of dealing with hazardous chemicals (2/33)
- e) Personal contact (1/33) – customer relationship (1/33)
- f) Reasonable terms of payment (1/33)
- g) Product delivered to where it is needed (1/33)

Due to the nature of the information and the repetitiveness of the themes it was not difficult to pick up frequently used words and phrases that could be analysed for frequency in question one. It will be seen how the aforementioned customer needs align with the ranking of key drivers for logistics efficiency improvements in the quantitative Q14 and elements of service customers need from distributors in the quantitative Q15. It is clear that for the responses above 3 of 33, a, c, d, e, f, g, h, i, j, k, l, n and below 3 of 33, a, b, c, d, e, g, there are 19 out of the 22 aspects of what customers need that can be directly impacted by efficient logistics, re-enforcing the importance of efficient logistics for customer service excellence as argued by Gattorna (2007), Craig (2012a) and Christopher (2011). These views

are echoed under best practices for logistics in the qualitative Q1.3, g, h and o below. The above stated needs can be translated into strategies for improved logistics efficiencies in the chemical distribution sector.

Quantitative questions 1, 2 & 13: Importance of customer needs and best practice.

The statements in table 4.1 seek to establish perceptions of the subjects relating to concepts identified in the literature regarding the importance of understanding customer needs to correctly align logistics for efficient customer service (Gattorna, 2010; Christopher 2011), the concept of best practices for improved logistics in the chemical sector (Birnbaum, 2006) and the current status in the sector.

Table 4.1 Perception of ‘customer needs’ and ‘best practice’ concepts and current status of logistics in the chemical distribution sector

OBJ	QUEST	STATEMENT	Mean Score			
			Cust	Dist	Supp	Sample
1	Q01	Understanding customer needs important to structure logistics operations	4.71	4.83	4.94	4.83
1	Q02	Best practices improve logistics efficiency for customer service	4.49	4.62	4.65	4.59
1	Q13	Most of my suppliers' logistics arrangements meet my needs	3.63	3.26	3.53	3.47

In table 4.1 the mean score out of 5 for customers, distributors, suppliers and the total sample are reflected. Because the aggregate score for Q01 reflects high levels of agreement 4.83/5 (97%) that understanding customer needs is important for structuring of logistics operations it would be expected that the experience of suppliers’ logistics arrangement meeting needs in Q13 would also be high. Therefore it is incongruent that the sample population aggregate rate for Q13 only reflects 3.47/5 (69%). This indicates room for improvement in logistics efficiency from suppliers and distributors to customers. It could also indicate a level of hubris, where distributors believe they know customers’ needs but have not taken time to ask their customers what they need (Kioll, Toombs, and Wright, 2001). Nonetheless it is also noted that customers rate Q13 (3.63/5) significantly higher than distributors do. The Q01 rating for need to understand customers in order to structure logistics operations correlates to the responses in the qualitative research relating to implementation of best practice for logistics improvements. It is also noted that although suppliers rated understanding their customers highest

4.94/5 (99%), the distributors who are their customers rated Q13 suppliers' logistics arrangements meeting their needs at the lowest (3.26/5). This illustrates the complexities for distributors operating between suppliers and customers, matching supplier lead times and delivery efficiencies to customer's need for prompt delivery with short lead times, noted as most important in question 1.1 in the qualitative research.

The rating for implementation of best practices to improve logistics is closer in suppliers and distributors with a lower rating from customers, which reflects the less sophisticated nature of the small and medium size customers in this business sector.

Quantitative question 14: Key drivers for logistics improvements

In order to understand what areas to focus efficiency improvements on it was necessary to confirm the key drivers for efficiency improvement in logistics. Subjects were requested to rank the key drivers for logistics efficiencies identified in the literature from 1 to 6, with 1 being the most important key driver and number 6 being the least important. Table 4.2 gives the analysis of the ranking for the total sample population of each of the key drivers.

Table 4.2 Analysis of ranking of key drivers for logistics improvement

Rank	Maximise profits	Customer Service Excellence	Maximising use of people and assets	Reduced Lead times	Competitive advantage	Reduced inventory holding
1	15.24%	65.71%	6.67%	2.86%	6.67%	2.86%
2	19.05%	15.24%	21.90%	16.19%	19.05%	8.57%
3	10.48%	8.57%	19.05%	26.67%	23.81%	11.43%
4	19.05%	4.76%	13.33%	18.10%	25.71%	19.05%
5	19.05%	2.86%	17.14%	27.62%	9.52%	23.81%
6	17.14%	2.86%	21.90%	8.57%	15.24%	34.29%

In table 4.2 customer service excellence ranking as the most important key driver for logistics improvements, with 65.71% of subjects ranking it 1st, with the highest concentration of data points, and the least dispersion around the mean, reinforced the purpose of the study to improve logistics efficiency for customer service. For competitive advantage, maximising of profits, reduced lead times, and maximising use of people and assets the data was fairly evenly distributed over the balance of

the rankings. For reduced inventory holding there was a stronger concentration of data points around the lower ranking, with 34.29% of subjects ranking it least important (6). The overall ranking is shown more clearly in figure 4.1. For statistical analysis the scores for the ranking were inverted (with number one rank given a score of 6) to establish an aggregate score that correctly reflects the most important rank highest on the bar chart.

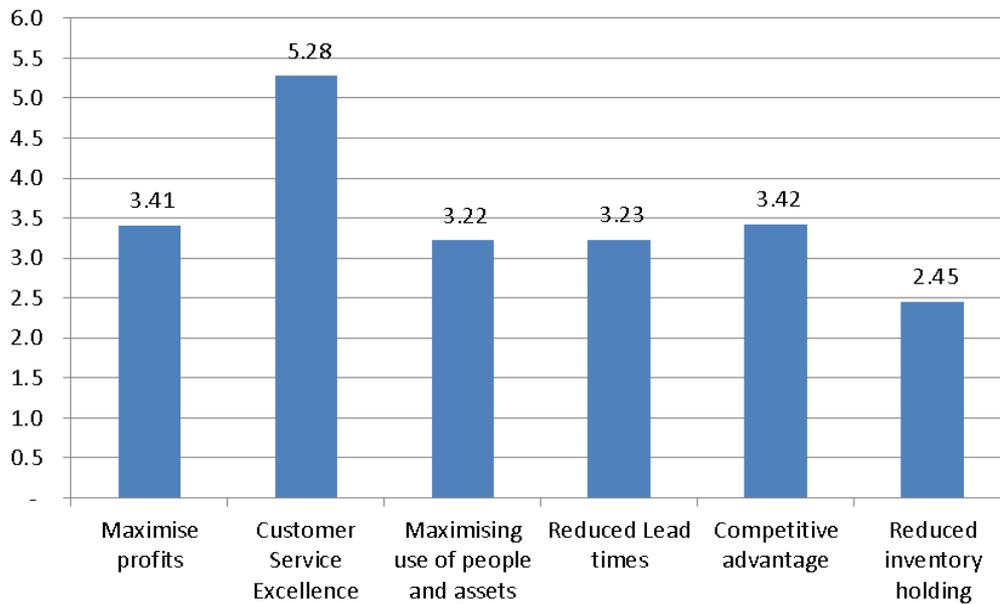


Figure 4.1 Overall ranking of drivers for efficiency improvement

In the overall ranking for the whole sample population in figure 4.1 the mean for customer service excellence clearly stands out above the rest. Competitive advantage and maximised profits are a close second and third. The fact that reduced inventory holding ranks as least important correlates to the need for stock availability, on-time deliveries, and consistency of supply reflected in the qualitative Q1.1 for what customers want from distributors and to the ranking of on-time deliveries in quantitative Q15. This statistical result reflects that distributors aim for customer service excellence to set themselves apart in a mainly commodity product distribution sector, correlating to the arguments by Gattorna (2010) and Christopher (2011) regarding the importance of logistics efficiency for customer service excellence. This is confirmed by competitive advantage ranking second and maximising profits third.

In table 4.3 the split between rankings of the different categories of subjects reveals a closer correlation between customers and distributors than between suppliers and customers.

Table 4.3 Ranking of Key drivers for logistics improvements per category

	Rank	ALL	Rank	CUST	Rank	DISTRIB	Rank	SUPP
Maximise profits	3	3.41	3	3.47	3	3.29	3	3.57
Customer Service Excellence	1	5.28	1	5.22	1	5.52	1	4.71
Maximising use of people & assets	5	3.22	2	3.49	5	2.88	4	3.29
Reduced Lead times	4	3.23	4	3.24	3	3.29	5	3.00
Competitive advantage	2	3.42	5	3.10	2	3.60	2	4.00
Reduced inventory holding	6	2.45	6	2.47	6	2.43	6	2.43
Correlations				Cust:Dis	Dist:Supp	Cust:Supp		
				94%	91%	85%		

In table 4.3 customer service excellence is ranked number one in importance by all categories. The mean score per category per key driver varies. Tests on the variability of the data reflected that the correlation between customers and distributors was 94%, the correlation between distributors and suppliers was 91%, while the correlation between customers and suppliers was only 85%, which illustrates the important role that distributors play between customers and suppliers. Figure 4.2 reflects the importance that distributors ascribe to customer service and clearly shows the split in the ranking of the key drivers between the categories.

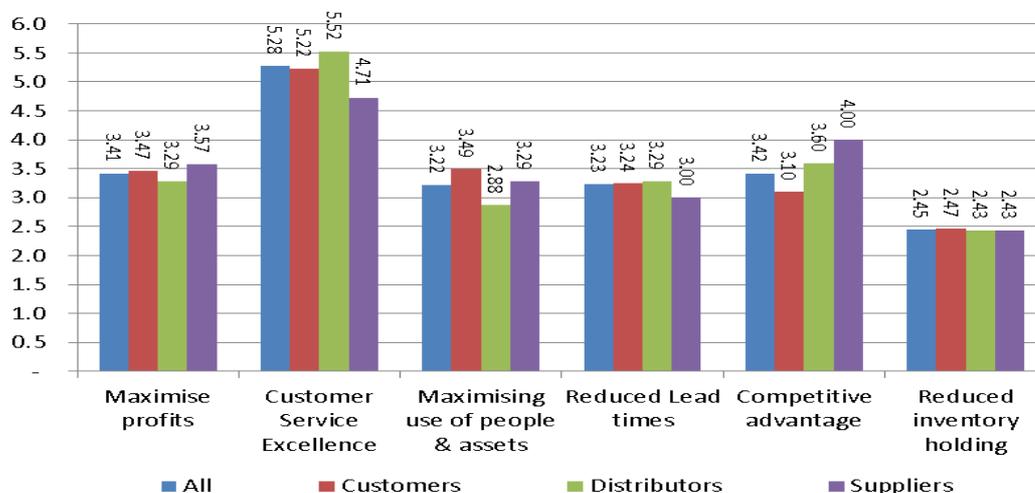


Figure 4.2 Ranking of key drivers for logistics improvements per category

In figure 4.2 the difference between distributor and supplier ranking of customer service is significant. Suppliers rank competitive advantage more significantly than distributors, and this is where the ranking for customers deviates from the rest as customers rank maximising of people and assets 2nd and competitive advantage 5th. In correlation with the results for Q13 the suppliers' ranking of reduced lead times is below that of customers and distributors. Suppliers place stronger emphasis on maximisation of profits (3.57), while distributors give even weight to this and reduced lead times at 3.29 each. It is important to note that distributors fall 10.50% below the mean on maximising of people and assets, which is required for the improvement of logistics efficiencies according to the qualitative data and the statements by Hayes (2004) and Nickel (2006) regarding effective use of people and Craig's (2010) reference to good stewardship of resources for efficient logistics. Customers' ranking of people and assets as 2nd also correlates to the low rate of implementation of technology by customers, which requires more of people and assets to run manual systems.

Quantitative question 15: Ranking of elements of customer service

In order to statistically confirm what the literature and qualitative data revealed relating to what customers want from distributors, so that logistics efficiencies can be correctly aligned to customers' needs, subjects were asked to rank 7 elements of customer service, with 1 representing the most important element and 7 representing the least important. The values were inverted for statistical analysis to calculate the aggregate score and represent the data graphically. Table 4.4 illustrates the ranking overall and per category of subject.

Table 4.4 Ranking of elements of customer service per category

	Rank	ALL	Rank	CUST	Rank	DISTRIB	Rank	SUPP
Availability of inventory	1	5.67	1	6.13	2	5.43	3	4.77
On time deliveries	2	5.52	2	5.29	1	5.52	1	6.38
Complete orders	5	3.39	4	3.35	5	3.62	7	2.77
Lowest price	3	4.38	3	4.33	3	4.29	2	4.85
Technical Advice	7	2.41	7	2.33	7	2.36	6	2.85
Short lead times	6	3.20	6	3.21	6	3.14	4	3.38
Accuracy	4	3.43	4	3.35	4	3.64	5	3.00
Correlations		Cust:Dis		Dist:Supp		Cust:Supp		
		97%		87%		81%		

In table 4.4 the correlation between customers and distributors is stronger (97%) for ranking of elements of customer service than it was in table 4.3 for key drivers for logistics improvements. According to Gattorna (2007 and 2010b) distributors' understanding of customer needs in the sector puts them in a strong position to correctly align their logistics to satisfy customer requirements, ensuring a competitive advantage. The different ranking for each category is noted. Where customers rank complete orders 4th, distributors rank it 5th and suppliers rank it 7th this reveals an area for improvement in priorities for logistics efficiency for distributors. It may pose a challenge if suppliers don't improve the priority of completed orders, especially considering the distance between data points (23.48% distributors to suppliers) in this regard.

Figure 4.3 graphically demonstrates the split in the ranking of the elements between the categories.

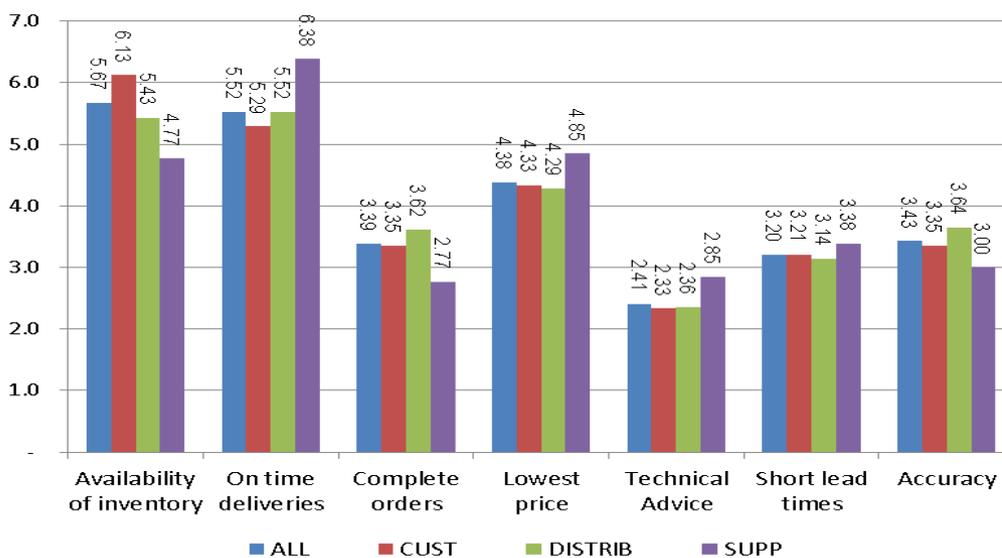


Figure 4.3 Comparative ranking of elements of customer service by category

In figure 4.3 the 15.57% variance from the mean in ranking score by suppliers (6.38 – 5.52) for on time deliveries reflects a negative correlation to the supplier ranking for lead times in quantitative Q14 figure 4.2 (-48%). The customers (6.13/7) ranked availability of inventory more strongly than distributors (5.43/7) and suppliers (4.77/7) with the distance between data points (22.14%) between customers and suppliers. Suppliers put stronger emphasis on lowest price as a

need than do customers and distributors, while distributors and customers put more weight on complete orders than do the suppliers (18.27% below the mean). This variance in ranking of elements between suppliers, distributors and customers adds to the complexities faced by distributors in meeting customer needs through efficient logistics. It emphasises the recommended best practice in the qualitative data Q1.3 for contractual and service level agreements with suppliers. Figure 4.4 illustrates the overall ranking of the elements.

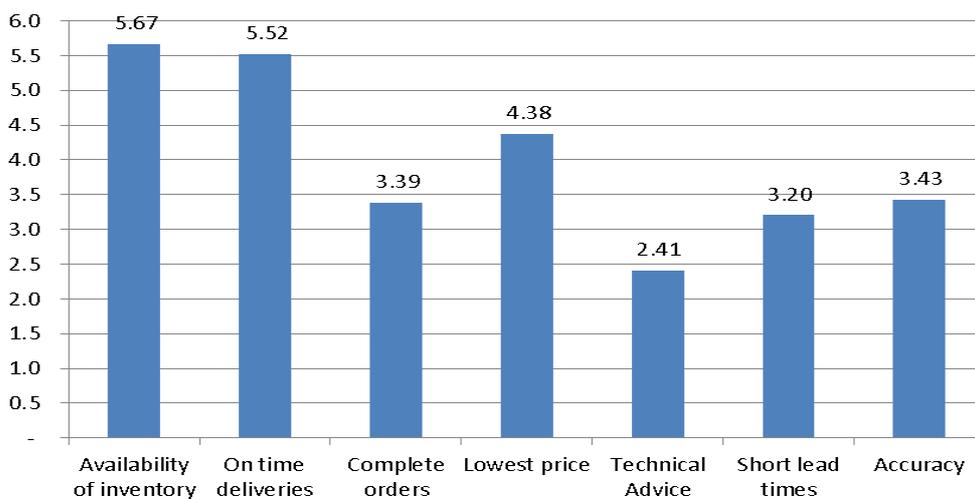


Figure 4.4 Overall ranking of elements of service customers need

In figure 4.4 the rankings show a correlation to the qualitative data Q1.1. Overall the availability of inventory, on time deliveries and lowest prices are highest ranking respectively. It is noted that based on the qualitative data Q1.1 the ranking exercise in the quantitative questionnaire is missing an element, as product quality was strongly emphasised in the qualitative data. Accuracy ranking as 4th correlates to the mean rating for technology accuracy at 70% (3.50/5) in the quantitative Q17.3. This infers the benefit of technology implementation to achieve this element of customer service. The overall ranking of the elements of customer service in Q15 highlights the need for the effective use of ERP's and MRP's /IRP's and demand forecasting discussed in the literature and qualitative data and investigated in Q17 and Q18 of the quantitative data. If customers make use of production planning systems investigated in Q18 these assist in the accuracy of demand forecasting and aid distributors in holding correct levels of inventory.

Qualitative question 1.2: Logistics challenges faced by distributors

Understanding the challenges faced by distributors will assist in determining what logistics best practices and technologies can assist in improving customer service. The open-ended responses were consolidated and the main themes relating to challenges faced by distributors were summarised. Thereafter they were grouped by the researcher into logical areas of the distributors' business that would be impacted by the challenges and lend themselves to best practices and technologies for logistics efficiency improvement as follows: i) The External Business Environment, ii) The Supply Side, iii) The Internal Business Environment and iv) Inbound and Outbound.

- i. The External Business Environment:
 - a) Compliance with legislation and the cost thereof
 - b) Dealing with hazardous chemicals and incompatible goods and safety in handling of products
 - c) Geographic dispersion of suppliers and customers
 - d) Condition of the roads, congestion and road closures
 - e) Strikes and political unrest
 - f) Increasing costs of logistics, toll roads, fuel prices, licenses and so forth
 - g) Competitiveness and volatility of the commodity chemical market on price, supply and demand and fickleness of customers
 - h) Seasonality of products

The findings in i) a, c, d, e, and f correlate to the findings of the State of Logistics Survey (Ittmann and King, 2011) and the aspects of transport challenges discussed in the literature review. Points i) a, d, e and f further correlate to the Barloworld Logistics Supplychainforesight 2012 survey findings. Then i) a, b, c, d, g and h also relates to the assertions of Engel and Roolfs-Broihan in Budde et al (2006) for the need of chemical distributors to optimise skills and resources for handling of frequent and timely deliveries over distances.

- ii. The supply side:
 - a) Finding reliable and trustworthy sources of supply locally and overseas
 - b) Finding the correct specification and quality of product

- c) Correct packaging, packaging quality and markings
- d) Port congestion, exchange rate volatility, long lead times, complexities of shipping and logistics on imported product
- e) Import communication, time zone differences, documentation and controls
- f) Consolidation of smaller mixed loads to avoid excessive large bulk orders
- g) Timing of orders to meet unpredictable customer demand, supply availability and lead times, to avoid stock piling

The need for reliability in ii) a above impacts on the stated need of customers for reliability in f of Q1.1 “what customers need from distributors”. The findings above align with the stated need for supplier agreements (Baker, 2012) and contracts (Hayes, 2008; Luo, Xu and Li, 2005) and enforcing of good packaging and labelling standards with suppliers, and difficulties caused in receiving due to issues with documents (Collins, 2008) noted in the literature. Supplier contracts and service level agreements are further recommended in the qualitative research as a best practice (Q1.3, c). Challenges noted in ii) f and g correlate to Poirier’s (2005) highlighted needs for accurate supply and demand forecasts for efficient transport and logistics and capacity planning. Beesley (2010) and Christopher (2011) further noted that the longer lead times in the supply chain created more room for error in forecasting of replenishment requirements. Further investigation is necessary to identify how the constraints in ii) d and e will be impacted by their recommendation for time compression. The recommended best practice of good planning and forecasting (Q3, k) affects ii) d through to g above. The findings in ii) d, e, f and g above and in iii) d, e, f, g and h below lend themselves to technology solutions for communication, information flows, inventory replenishment planning, demand forecasting and transport management systems discussed in the literature and investigated further in the quantitative data. Transport management systems can further include fleet maintenance tools to cover iii) f and the recommended best practice in Q3 s below relating to vehicle condition and maintenance.

iii. The Internal Business Environment:

- a) Finding correct, relevant skills at the correct level for the various jobs done
- b) Matching training available to training needs and operational timing
- c) Having sufficiently skilled and knowledgeable staff with the right attitude

- d) Volume and range of stock to be held in order to ensure availability of supply
- e) Cost and difficulty of moving stock between branches
- f) Different size trucks needed for varying customer delivery options and size and frequency of order, and keeping trucks in good condition
- g) Proper planning and planning skills to streamline orders and deliveries
- h) Where import of part containers are not possible the risk of high volumes of speciality stock reaching its expiry date before it is sold.
- i) Overall costs of operations: procurement, imports, sales, admin, training, warehousing and distribution; containment while ensuring customer satisfaction

The findings in iii) a through to g above are all related to the assertion made by Engel and Rooffs-Broihan (2006) that the most effective and profitable chemical distributors are those who have the skills to maximise their warehouse and transportation capacity. The stated challenges iii) a, b, c, e, and g align with those identified in Ittman and King (2011) and Barloworld Logistics (2012). Then iii) a, b, c, f and g align with the skills issues discussed by Frankemolle (2006) and Valk (2011). Findings in iii) a, b, c, and g further reinforces the need for identification of scarce skills and planned training and transference of skills in the workplace (Kilbourn and Wessels, 2011). The training issues are discussed at length in section 2.7 of the literature review and recommendations are dealt with in chapter 5. The skills aspects are discussed in objective three and in the skills development methods investigated in the quantitative data analysis Q19.

The cost challenge referred to in iii) i above correlates to the value chain concepts of difference between the value added to the customer and the total cost of providing it, and the critical goal of the value chain analysis to maximize value creation while minimizing total costs for sustainable competitive advantage (Porter, 1985). The aspects of cost management and trade-offs are covered in depth in the business, operations and management concepts section, and illustrated in figure 2.4 "Cost Trade Offs in the Total Logistics Concept of the literature review. It is further noted that in their transport management system study Aberdeen Group Inc. (2007) found a strong correlation between use of WMS and TMS systems

discussed in Q18 of the quantitative data and reduced inventory, reduce costs in inventory holding and transport and logistics.

iv. Inbound and Outbound:

- a) Finding reliable, efficient, Hazchem compliant and cost effective logistics providers
- b) Attaining sufficient volume to maximize loads
- c) The break bulk nature of distribution to the smaller customers
- d) The majority of orders are placed for delivery in the first week of the month causing capacity bottlenecks
- e) Offloading at smaller customers with limited space and without equipment
- f) Moving the right volumes of low cost products without damage to ensure customer service and profit
- g) Managing customer's ordering habits and their unrealistic expectations on lead times and deliveries
- h) Matching supply and demand to ensure flow through of products to customers
- i) Queuing for deliveries and collections at customers and suppliers
- j) Managing customer returns

The above findings, iv) a, b, c, d, e, f, h and j lend themselves to the networking and outsourced solutions discussed in the literature and Q1.3, p below. Points iv) b, c, d, e, f, g, h, i, and j further reflect some of the issues discussed in the extra distance analysis tool concept discussed by De Swardt, Potter, Robinson, and Sanchez-Rodrigues (2011). However iv) c, d and e will not necessarily be answered by the extra distance tool and will need further investigation for solutions. Some of the management tools, technologies and information systems as possible solutions relating to some of these challenges are further investigated in quantitative questions Q16, Q17 and Q18 respectively.

Qualitative question 1.3: Best practices in logistics operations for customer service

An investigation into the subjects' views on what are best practices in logistics operations for customer service revealed:

- a) Sufficient and suitable load capacity in receiving and dispatch areas and in the delivery fleet to meet delivery requirements
- b) Strict and efficient stock control and maintenance of stock levels
- c) Contractual agreements with suppliers with service level agreements
- d) Management of loads for compatibility of products to ensure timely delivery
- e) Efficient order handling, correct documentation and correct stock delivered
- f) Avoidance of part deliveries
- g) Listening to and implementing procedures to meet customer needs
- h) Ensuring sufficient skill, knowledge, understanding of customer needs and customer service excellence throughout the organisation
- i) Maximising warehouse efficiency and capacity with shelving and racking
- j) Docking and loading areas close to storage to reduce on and off loading times
- k) Good planning and forecasting
- l) Pre-planning of truck routes and loads for faster marshalling and dispatch
- m) Short delivery times to customer with advanced notice of delay in dispatch or longer lead times
- n) Constant, accurate and reliable information between customers, distributors and suppliers
- o) Categorising customers for prioritising them for service levels
- p) Outsourcing where necessary, with contracts and service level agreements
- q) Specialising in a range of products for narrower focus and optimised logistics
- r) Ensuring traceability of stock
- s) Well maintained, reliable equipment and vehicles with well trained staff who understand the processes to ensure on time, complete and correct orders

An extensive search of the qualitative data collected regarding best practices for logistics revealed that none of the subjects recommended the use of information systems and technology as a best practice. Given the wide range of solutions identified in the literature reviewed it is asserted that a number of the above recommended best practices, such as Q3 b, d, e, f, g, k, l, m, n, o, q, r and s, are best achieved or enabled through technology and information systems. The majority of the best practices identified above are covered in some way in the

literature reviewed and can be supported by the management tools discussed in quantitative Q16.

The recommended practice in Q3 d takes into account the complexity of the industry sector in load management, where a solution has been defined in the organisation's information system for analysing and splitting orders for compatibility of products. This then requires the further solution of load management through a transport management system. A key best practice, Q3 k, impacts on a number of the other recommended best practices, as highlighted by Poirier (2005) and De Swardt, Potter, Robinson, and Sanchez-Rodrigues (2011). Although Q3 m above makes some mention of the advanced notice, there was little mention of this in the qualitative data. It is noted that Hansen Harps (2005) and Collins (2008) refer to the advance shipping notices (ASN) as an important best practice for optimisation of warehouse and transport management. It is noted that overall frequency of implementation of this in Q16 of the quantitative data is 45.45% with a standard deviation of .50 and its average rating for effectiveness is 73%.

The best practice in Q3 o aligns with Closs, Mollenkopf, and Keller's (2005) concept that chemical distributors should understand that "not all customers are equal" and segment them to develop tailored logistics solutions for their leading customers. Although Eisberg (2010) refers to organisations that have tended to specialise it is not recommended as a best practice in the literature. In Q3 q above the subject recommends this as a best practice to streamline and optimise logistics and marketing efforts. The best practice in Q3 r referring to stock traceability is not covered in the literature reviewed, except for mention of barcoding and batch tracking tools in information systems. However this practice is significant for this sector, for the management of stock in, to ensure compliance with certificates of analysis and stock meeting specifications, for handling customer quality complaints, for product recall management and control of customer returns, which is mentioned in Q2 iv) j inbound and outbound logistics challenges above.

Considering the challenges noted in qualitative Q1.2 above, the strong emphasis in the literature on performance measurement (physical, financial, human, assets, capacity usage, productivity, inter alia) which can assist in managing and alleviating some of these as issues, and the high frequency rate of implementation of performance measurement (71.07%) in quantitative Q16, it is incongruous that this is not considered in the qualitative data as a best practice for logistics efficiency improvement.

Quantitative question 16: Best practice management tools

Having identified the management tools in the literature review as possible best practice solutions, the subjects were asked to indicate which of the identified best practice tools had been implemented in their organisations. The frequency rates of implementation per category of subject are listed in table 4.5

Table 4.5 Rates of implementation of management tools per category

Code	Rate of implementation	ALL	Cust	Dist	Suppl.
BM	Bench Marking	32.23%	27.12%	33.33%	47.06%
PM	Performance measurement	71.07%	66.10%	75.56%	76.47%
ASN	Advanced Shipping Notices	45.45%	32.20%	64.44%	41.18%
JIT	Just-in-Time	25.62%	22.03%	28.89%	29.41%
Lean	Lean Methodology	14.88%	15.25%	8.89%	29.41%
Pmap	Process Mapping	26.45%	23.73%	24.44%	41.18%
DF	Demand Forecasting	66.12%	54.24%	80.00%	70.59%
CI	Continuous Improvement	71.07%	71.19%	73.33%	64.71%
PR	Process Re-engineering	23.14%	16.95%	20.00%	52.94%
CSS	Customer Satisfaction Surveys	57.85%	49.15%	60.00%	82.35%
TC	Time Compression	14.05%	16.95%	13.33%	5.88%
Std	Standardisation	32.23%	27.12%	37.78%	35.29%
ISO	ISO Procedures	60.33%	47.46%	73.33%	70.59%
SixS	Six Sigma	5.79%	3.39%	2.22%	23.53%
Oth	Other	0.00%	0.00%	0.00%	0.00%
	Average rate of implementatio	39%	34%	43%	48%
			Cust:Dis	Dist:Supp	Cust:Supp
	Correlations		92%	82%	82%

In table 4.5 the correlation between the customers and distributors is again higher than that for distributors and suppliers and suppliers and customers. Although performance measurement (PM), continuous improvement (CI), demand

forecasting (DF) and customer satisfaction surveys (CSS) score well in implementation frequency rates, the overall frequency rate of implementation of management tools (39%) is low, with a standard deviation of .49, with customers overall frequency of implementation at only 34%. The codes assigned to each management tool in table 4.5 are used due to space constraints in figure 4.5 and figure 4.6 which graphically illustrate the data presented in table 4.5 for the overall rate of implementation and the frequency rate of implementation per category of subject.

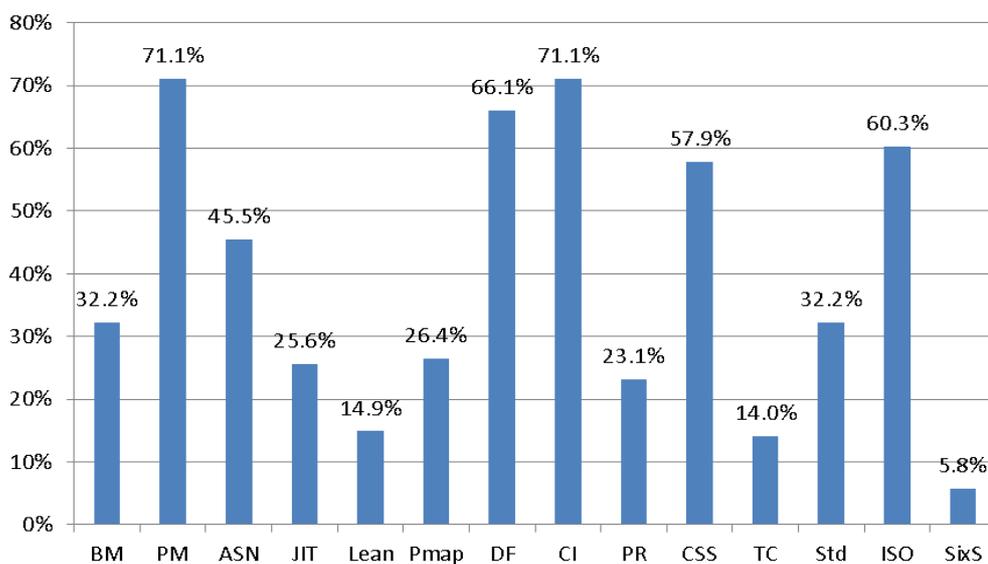


Figure 4.5 Overall frequency rate of implementation of management tools

The most frequently implemented tools indicated in figure 4.5 are performance measurement (PM) and continuous improvement (CI) equally, demand forecasting (DF), ISO operating procedures (quality system) (ISO) and customer satisfaction surveys (CSS). The fact that PM rates as the most implemented practice correlates to the recommendation in the qualitative data Q1.5e below of an ISO quality system underpinning best practices with performance measurement. This aligns with the literature review where it was noted that sustained operational improvement requires regular performance management (Porter, 1985; Halley and Guilhon, 1997; Birnbaum, 2006). The further management of processes and controls in ISO correlates to the ranking of accuracy as 4th in Q15 and the HR strategies discussed in the qualitative data. The ISO system includes the use of CSS which is the 5th most implemented practice.

The equally most implemented tool, continuous improvement (CI), is necessary for improving efficiency in logistics and maintaining the competitive edge (Nickel, 2006) and correlates to the high ranking of this (ranked 2nd) and customer service excellence in Q14. Its high frequency rate of implementation aligns with Angelis, Conti, Cooper and Gill's (2011) assertion that CI needs to be a culture in an organisation. A stronger correlation would be expected between this and the ranking of maximising of people and assets for logistics improvements as these are strongly linked in the literature.

The high rate of implementation of demand forecasting correlates to the noted requirement in the qualitative data to match supply and demand for stock availability and flow through of products to customers, which is reinforced by the research of Sanchez-Rodrigues et al (2010), which asserts that without accurate demand forecasts the organisation cannot properly plan its transport and logistics for efficiency and capacity usage.

Considering the close relationship between the concepts of bench marking (BM), standardisation (Std) and process mapping (Pmap), and performance measurement, ISO and continuous improvement in best practice, the much lower rates of implementation of BM, Std and Pmap are unexpected. This would indicate that the distribution sector has not yet grasped their benefit for business process and logistics efficiency improvements. There further appears to be incongruence between the qualitative data inference that customers want on time, prompt deliveries, stock availability with consistency of supply and short lead times, the data supporting this in Q15 and the apparent low implementation rate of just in time (JIT). It is proposed that although customers are actually employing JIT, due to lack of understanding of the JIT concept the score for frequency of implementation is low (22.03% customers and 26% overall), suggesting a false negative result. The best practice concepts of lean methodology (Lean), time compression (TC) and six sigma (SixS) have very low overall adoption rates. However figure 4.6 reflects that suppliers have a much higher adoption rate for these than customers and distributors.

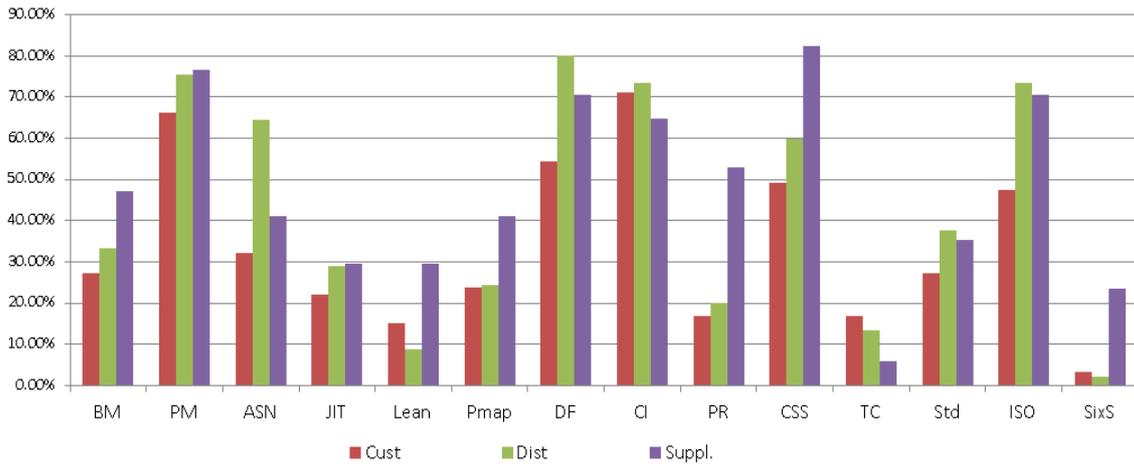


Figure 4.6 Frequency of implementation of management tool per category

The much higher adoption rate by suppliers reflected in figure 4.6 for process reengineering (PR), process mapping (Pmap), lean methodology (Lean) and six sigma (SixS) is most likely related to their high concentration of sophisticated manufacturing environments and processes for production of the chemical raw materials. For the majority of customers their processing or manufacturing environments are less sophisticated as they involve simpler blending processes. It is noted that the low overall implemented SixS (5.79%), TC (14.05%), Lean (14.88%) and PR (23.14%) are closely linked in the methodology and application. Except for SixS these tools are not complicated to operate or difficult to understand. The tools that are useful for efficiency improvement but have a low frequency of implementation by distributors are bench marking, process mapping, process re-engineering, time compression, lean methodology, and six sigma.

The low frequency of implementation of DF by customers (17.97% below the mean and 32.20% below distributors) makes matching volume demand difficult for distributors to improve their inventory holding and on time delivery efficiency. It is noted that distributors use advanced shipping notices (ASN) much more (41.78% above the mean) than other categories, which should assist in reducing queuing time at customers' receiving areas.

Quantitative question 16.2: Are best practice management tools properly run and monitored?

Subjects were asked to answer yes or no to whether they were properly run or monitored, as this impacts their effectiveness for logistics efficiency improvements. Figure 4.7 indicates the overall frequency of subjects that believed the tools are properly run and monitored.

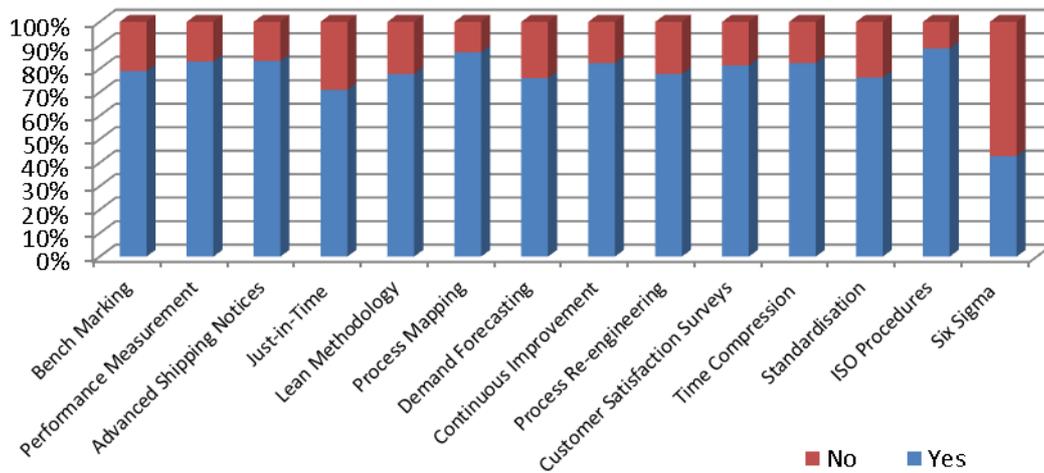


Figure 4.7 Overall rating of management tools properly run and monitored

Except for Six Sigma and just in time, the overall view is that the tools are being properly run and monitored as indicated in figure 4.7 by a high percentage frequency of agreement with a standard deviation of .48. Therefore, where the distribution sector has implemented best practice management tools they are well run. However the impact of these will not be significantly noted as a result of their very low overall adoption rate in the sector, as indicated in table 4.5. This is evident from the challenges and complexities recorded in the qualitative data collected.

Quantitative question 16.3: Rate each of the management tools for effectiveness.

Here the subjects rated the tools, with 1 representing poor effectiveness and 5 representing excellent effectiveness, from current and previous experience, irrespective of whether they are currently implemented in their organisation. Figure 4.8 indicates the overall rating for the effectiveness of the tools.

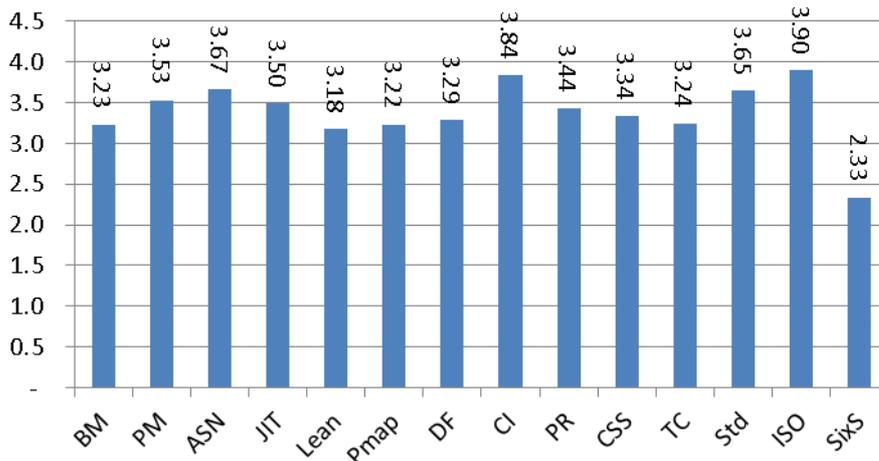


Figure 4.8 Overall rating for effectiveness of best practice management tools

In figure 4.8 the management tools rated the most effective in the chemical industry is the ISO, followed by continuous improvement (CI), advanced shipping notice (ASN), standardisation (Std), performance measurement (PM) and just in time (JIT) respectively, with a standard deviation of .90. All except six sigma (SixS) rate above 60% (3/5), indicating that they do add value to the chemical industry. Figure 4.9 indicates that distributors rank a number of the best practice management tools significantly less effective than do the customers and suppliers.

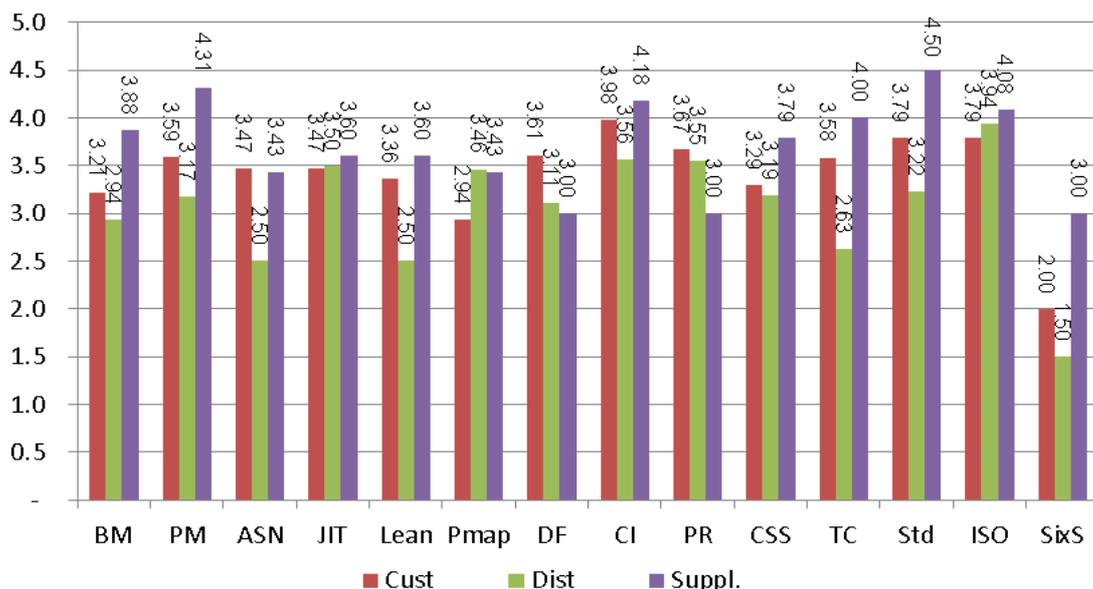


Figure 4.9 Rating for effectiveness of management tool per category

It is noted in figure 4.9 that for bench marking (BM), performance measurement (PM), advanced shipping notice (ASN), lean methodology (Lean), demand

forecasting (DF), continuous improvement (CI), process reengineering (PR), customer satisfaction surveys (CSS), time compression (TC), standardisation (Std) and six sigma (SixS) the customers rated them more effective than the distributors, in spite of their actual implementation rates, as indicated in figure 4.6, being lower. This may indicate the benefit that the customers derive from their distributors' use of the tools in serving their needs. The distributors rating them less effectively may be a symptom of the tension that is experienced by distributors: Trying to balance the needs and demands of the customer and the supplier and match demand and supply, with the complexities and constraints indicated in the ranking of what customers need from distributors and the elements of service and those noted in the qualitative data. This aligns to Eberhard's (2012) assertion that chemical distributors have a challenging role in offering a value chain between the chemical producers and the processing industries who manufacture the finished goods. The higher rating for effectiveness of process mapping and process re-engineering for distributors is linked to the rating for ISO, which requires these in order to set out standard operating procedures for efficiency. In figure 4.10 the correlation between the perception of effectiveness of the tools, how well they are run and their rate of implementation was analysed.

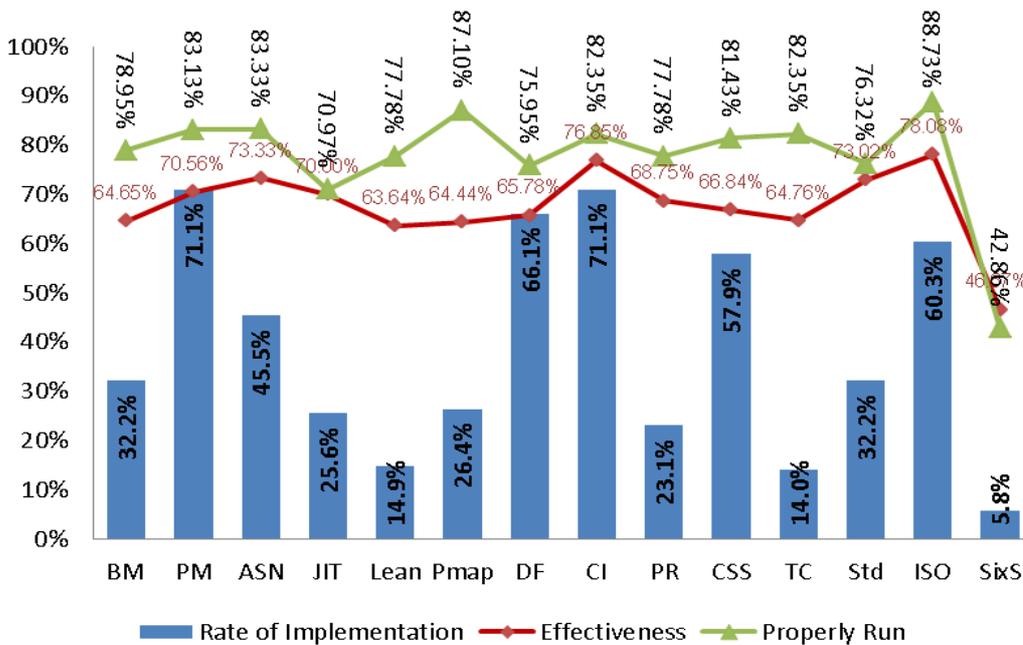


Figure 4.10 Correlation between properly run management tools, their effectiveness and rates of implementation

In Figure 4.10 the statistical analysis was done on all variables as percentages (no. of implementations out of 121 subjects; aggregate rating of “run and monitored” and of “effectiveness” as a % of total score of 5) for ease of comparison. The correlation between the management tools being properly run and their overall rating for effectiveness is 79%. The correlation on the SixS would reflect that because it is not properly run it is not effective. Then due to its apparent lack of effectiveness it may not be perceived by other organisations as worth implementing. ISO scores highest for effectiveness and being properly run. Continuous improvement (CI) rates 2nd highest for effectiveness and highly for being properly run. This indicates that where the management tools are used properly they will be effective for logistics improvements. The correlation is positive at 64% for rate of effectiveness and implementation. It is noted that for performance measurement (PM) and demand forecasting (DF) correlations between rate of implementation and effectiveness are not as high as for ISO and CI. The correlation between the tools being properly run and effective where there is a low rate of implementation indicates opportunities for the sector to take advantage of these good tools for logistics improvement. Further investigation would be required to understand why PM, DF and CSS are most implemented and properly run, but rated lower for effectiveness.

Qualitative question 1.4: What technologies are used to support efficient logistics?

The collated and summarised technologies identified by the subjects are:

- a) Bar coding systems for efficient picking and stock tracking
- b) Accurate stock movement reporting
- c) Computerised warehousing systems to shorten loading and unloading times with bin locations and management of first in first out with batch tracking
- d) Shipping providers Interactive shipping notification and tracking systems
- e) Vehicle Tracking and monitoring systems, pre-planned deliveries, route planning, area maps and Global Positioning Systems (GPS) to plan and set routes
- f) Delivery vehicle tracking to notify customers of expected delivery times
- g) Customer information, and communication tracking systems
- h) Telecommunication, Skype, electronic mail and communication systems

- i) Inventory planning, forecasting and replenishment tools
- j) Integrated Enterprise Resource Planning systems (ERP's)
- k) Reliable and effective accounting system: Pastel, SYSPRO, SAP with sufficiently trained personnel to maximise their use.
- l) Computers, printers and scanners

It is noted that in the detailed qualitative data, although the subjects had a strong overall emphasis on vehicle tracking and monitoring and noted some of the components of transport management systems (consolidated and summarised in Q4 e above) there appeared to be no total grasp of integrated Transport Management Systems and what they can do to improve logistics efficiencies. Other than the bar coding and batch tracking technologies noted above, there were a number of references to information system technologies as noted in Q1.4 b, c, e, g, j and k, but few specific references to the actual technology tools as listed in the quantitative data Q17. The recommended technologies were in the main low technology and in some cases subjects simply referred to either computers or information systems or to manual and human resource (skills) solutions. This may be as a result of the perception of the specific technology tools and information systems as being one and the same and inseparable in their application. However the lack of high technology solutions offered here is borne out by the low overall frequency rate of implementation of technologies in quantitative Q17, (15.50%) below. It will however be noted from the sections on warehouse best practices and the technologies to underpin best practices in the literature review that the technology tools are strongly indicated for improved speed, accuracy and efficiency in warehouse and logistics management.

Those technologies and information systems that have been referred to in Q4 a to l above align with the identified technologies and information systems from the literature reviewed. It is noted from the emphasis on technologies to improve communication, customer information and information flows, and the reference to it again in the qualitative data Q1.5, c below that there is a correlation to the emphasis by a number of authors in the literature relating to networked relationships and the importance of information to the flow of goods.

Quantitative question 17: Frequency of implementation of technology tools

To establish the current implementation rate of the technologies identified in the literature reviewed, subjects were asked to indicate which of the identified technologies are implemented in their organisations. Table 4.7 gives the breakdown of the frequency rate of implementation per technology per category.

Table 4.7 Percentage frequency of implement. of technology per category

Code	% Implementation	ALL	Cust	Dist	Supp
Btrack	Batch Tracking	66.12%	61.02%	77.78%	52.94%
Bcode	Bar Coding	25.62%	30.51%	15.56%	35.29%
RFID	Radio Frequency Identity tags	2.48%	0.00%	2.22%	11.76%
HHSD	Hand held scanning devices	9.92%	3.39%	15.56%	17.65%
VAD	Voice Activated Devices	0.83%	0.00%	0.00%	5.88%
APE	Automated Picking Equipment	4.96%	3.39%	2.22%	17.65%
AIC	Automated Inventory Counts	14.05%	15.25%	6.67%	29.41%
OTH	Other	0.00%	0.00%	0.00%	0.00%
Mean		15.50%	14.19%	15.00%	21.32%
Correlations			Cust:Dis 92.59%	Dist:Supp 83.94%	Cust:Supp 93.88%

In table 4.7, although the overall implementation rate of the technologies is very low at only 15.50% average, with a standard deviation of .36 for the sample population, batch tracking (Btrack), bar coding (Bcode) and automated inventory counts (AIC) are the most frequently implemented technologies, with standard deviations of .48, .44, and .35 respectively. The low overall adoption rate of the technologies is incongruent with the (91%) acceptance rate in quantitative Q03 above that technology can improve logistics efficiency. The customer category has the lowest frequency of adoption (14.19%) and the supplier group the highest rate of adoption (21.32%), scoring 37.61% above the mean which correlates to their highest acceptance rate 4.82/5 (96.47%) in Q03. The split of frequency rate of implementation of the technologies per category of subject is illustrated in figure 4.11.

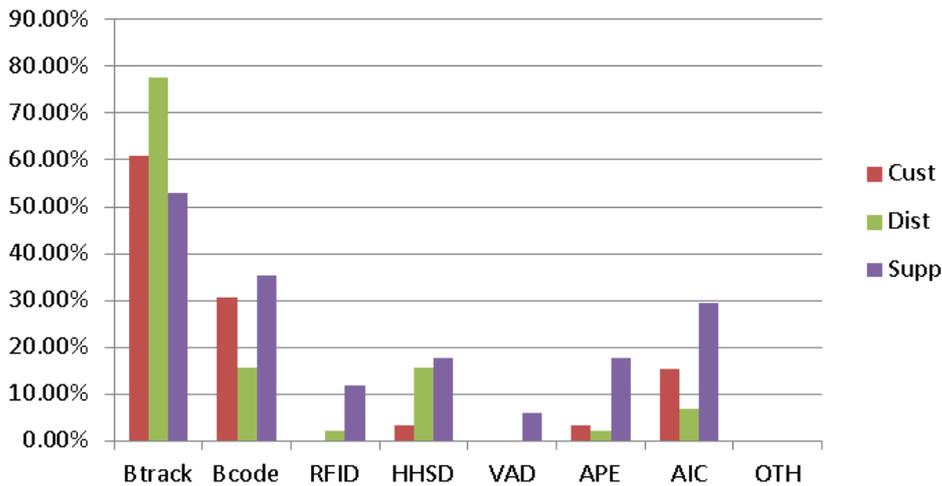


Figure 4.11 Percentage rate of implementation of technology per category

The high rate of adoption of batch tracking (Btrack) by distributors reflected in figure 4.11 is an indication of the importance of linking batches of products to certificates of analysis (COA), to verify quality of the product and product fit for use as it ties up to the specifications on the COA. This also assists the distributors in correct picking of product for dispatch, managing product recall and customer product returns. This correlates to the stated needs of the customer in the qualitative data Q1.1 above 3/33 c, d, f, g and h for correct product, fit for use, and Q1.1 below 3/33 c for correct documentation. The low rate of adoption of barcoding (Bcode) by distributors by comparison to that of suppliers and customers indicates an opportunity for distributors to make greater use of this technology for speed and efficiency of receiving and dispatch. The hand held scanning devices (HHSD), automated picking equipment (APE) and automatic inventory count (AIC) technologies rely on RFID or Bcode technology. There is therefore a correlation between the supplier's higher implementation of these related technologies.

Quantitative question 17.2: Rating technology tools for ease of use

Subjects were asked to rate the above technologies out of 5 for ease of use, with 1 representing very difficult and 5 representing very easy to use to assist in understanding their applicability in a low skilled or unsophisticated environment. Figure 4.12 shows the overall rating per technology for ease of use. The codes reflected in table 4.7 are used due to space constraints.

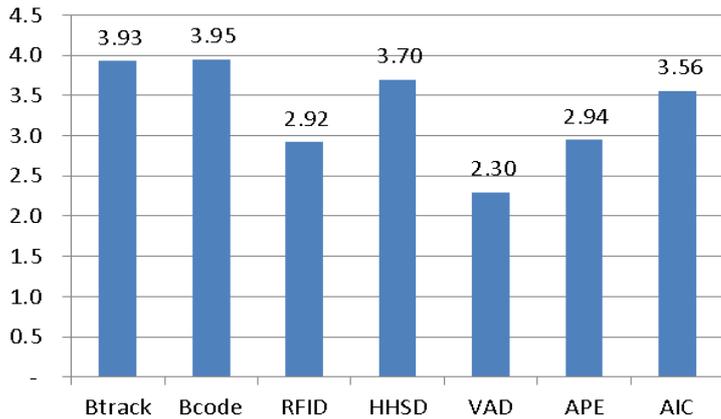


Figure 4.12 Average rating for technologies for ease of use

Figure 4.12 indicates a high ease of use rating for bar coding (Bcode) 3.95/5 (78.97%), batch tracking (Btrack) 3.93/5 (78.52%), hand held scanning devices (HHSD) 3.70/5 (73.91%) and automatic inventory counts (AIC) 3.56/5 (71.54%). The standard deviation on these was 1.96, 2.08, 1.56 and 1.61 respectively, indicating a wider dispersion around the mean for perceptions of their ease of use. Automatic picking equipment (APE) and radio frequency identification devices (RFID) also score above 58%. This suggests that increasing the adoption of the technologies should not be difficult in the chemical distribution sector.

Question 17.3: Rating of technology tools for accuracy of results

Accuracy ranked 4th for the elements customers want from distributors in quantitative Q15. It is therefore important for the technologies to give accurate outputs. Figure 4.13 shows the overall rating of the technologies for accuracy.

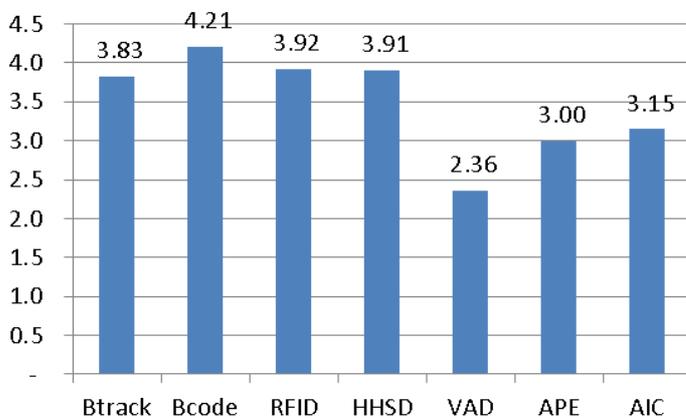


Figure 4.13 Overall rating for accuracy per technology

In figure 4.13 the Bcode 4.21/5 (84.10%), RFID 3.92/5 (78.33%), HHSD 3.91/5 (78.18%) and Btrack 3.83/5 (76.50%) are rated as most accurate of the technologies with a standard deviation of 1.63. AIC 3.15/5 (62.96%) and APE 3.00/5 (60%) also score above 59% for accuracy. There is a 77.18% correlation between the scores for ease of use and accuracy. Where batch tracking requires some manual input and hand held scanning devices require some manual operation barcoding and RFID are more highly automated in updating of data, with voice activated devices (VAD) processes (2.36/5) probably involving the most human and manual action. The high rating for accuracy of BCode, RFID, HHSD and Btrack reinforces these technologies as strong options for improved speed and efficiency in logistics, although the current cost of RFID may still preclude its use in a low margin commodity environment.

Quantitative question 17.4: Rating of technology tools for cost savings

Cost efficient solutions are an important element for competitive advantage in the low margin commodity chemical distribution sector. Therefore the subjects rated the technologies for their perception of the cost savings achieved through their use. The overall rating for their cost savings out of 5 are illustrated in figure 4.14

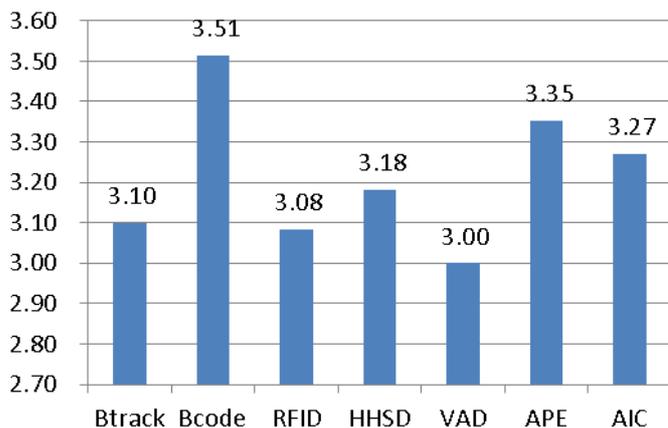


Figure 4.14 Average rating per technology for cost savings

In figure 4.14, barcoding (Bcode) 3.51/5 (70.27%) again scores the highest, followed by automatic picking equipment (APE) 3.35/5 (67.06%) and automatic inventory counts (AIC) 3.27/5 (65.38%). With hand held scanning devices (HHSD) (63.64%), batch tracking (Btrack) (62%) and voice activated devices (VAD) (60%)

all above 60% the view is that all of the technologies identified in the literature review are perceived to add beneficial cost savings to the operations. There is a very weak correlation between frequency rate of implementation and cost savings at only 2.99%. The correlations between the perceptions of ease of use, accuracy and cost savings against rate of implementation is illustrated in figure 4.15

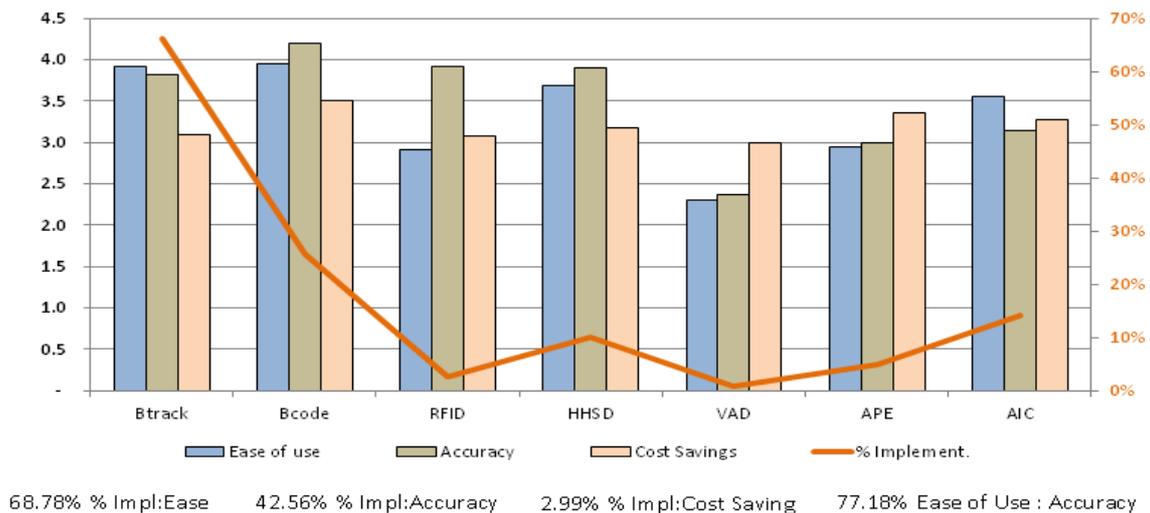


Figure 4.15 Correlations between technologies for Implementation, ease of use, accuracy and cost savings

The strongest correlations seen in figure 4.15 are for ease of use to accuracy (77.18%) and ease of use to implementation (68.78%). Frequency of implementation to accuracy correlates at 42.56%. The data indicates that cost saving is not as much a deciding factor in decision to implement as accuracy and ease of use are. This does not correlate to the views of the authors in the warehouse best practice section of the literature review, who note that movement of goods through the warehouse, incoming, internal and outgoing flows, impact the final cost of goods and value added to the customer. If these tools, which assist with the movement of goods through the warehouse, are rated on aggregate 64.29% to offer cost savings a higher rate of implementation would be expected. There is a 51.38% correlation between ease of use and cost savings. Further investigation would be needed to establish whether the distribution sector would require a higher level of cost savings to regard implementation as worthwhile, or whether the low adoption rate relates to affordability. Nonetheless, the applicability to the distribution sector is inferred by the average scores for ease of use, accuracy and cost savings, as reflected in table 4.8.

Table 4.8 Average score out of 5 per technology for ease of use, accuracy and cost savings versus frequency rate of implementation

Avg. scores for Ease, Accuracy and Cost vs Implementation		
Technology	Ave. Score	Implement.
Bar Coding	77.78%	25.62%
Batch Tracking	72.34%	66.12%
Hand held scanning devices	71.91%	9.92%
Automated Inventory Counts	66.49%	14.05%
Radio Frequency Identity tags	66.11%	2.48%
Automated Picking Equipment	61.98%	4.96%
Voice Activated Devices	60.40%	0.83%

The averages reflected in Table 4.8 give a strong indication for the applicability and further implementation of bar coding (score 77.78%: implementation 25.62%), batch tracking (72.34%: 66.12%) and hand held scanning devices (71.91%: 9.92%) for the sector, with automated inventory counts (66.49%:14.05%) and radio frequency identification devices also above 65%. All of the above technology equipment is strongly indicated for implementation of best practice for efficiency improvements, minimisation of touches, accuracy, speed and real time inventory information (Hansen Harps, 2005 and others) in the literature reviewed. The comparative low implementation rate correlates to the statements of Closs, Mollenkopf and Keller (2005) regarding the lag in the chemical industry for use of technology for accurate, timely and company wide information, which these technologies can provide when used with integrated information systems.

Qualitative question 1.5: What underpins best practice in chemical distribution?

From the collated and summarised open-ended data the following was identified:

- a) Safety, speed and compliance to standards and procedures
- b) Ability to afford the technologies required
- c) Communication between suppliers, customers, distributors and departments in the organisation
- d) Skilled, knowledgeable and disciplined staff with good attitudes, teamwork and information technology

- e) ISO Standards, quality policy and procedures, with a customer complaints and compliments system to measure performance
- f) Efficient stock management and sufficient stock on hand
- g) Reliable technology, information systems and fleet of vehicles
- h) Marketing and branding the products and the business
- i) Meticulous planning and scheduling
- j) Contracts between customers and suppliers
- k) On-going training, development and accumulation of knowledge about the products, the customers and the technologies available

Again the points noted in Q1.5 a to k strongly reinforce the concepts identified in the literature and their applicability to the South African chemical distribution sector. They are further underlined in the discussion on human resource aspects and correlate to the challenges noted in the qualitative data Q1.2 and the needs of customers listed in Q1.1 above. In the South African context the reference to affordability of the technologies (Q1.5 b) is significant and may be a strong indicator as to the reasons for the low rate of adoption of the technologies and information systems and emphasis on the human resource and skills aspects noted repeatedly throughout the qualitative and quantitative data.

4.5.2 Objective 2:

Determining what information system technologies may enable best practice logistics and improve efficiency of logistics operations

Qualitative question 2.1: Complexities in logistics processes that may lend themselves to information technology solutions

Understanding the mix of different logistics process difficulties and complications (complexities) faced by and possibly unique to the chemical distribution sector, that add to the issues requiring possible technology solutions will assist in identifying the correct information technology solutions.

A summary of the complexities stated by the subjects revealed the following:

- a) Range of products and compatibility of mixed loads of products. Grouping loads for customers
- b) Trend analysis, sales forecasting, planning and re-ordering of stock for accurate minimum stock holding, while ensuring availability to customers, margin maximisation and profit
- c) Flow of volumes in and out of designated areas and onto vehicles with best route planning for maximising fleet capacity and turn-around times
- d) Tracking of physical stock movement to ensure accuracy of stock records in the information system, accurate stock counts and avoid shrinkage
- e) Improving the accuracy of picking and despatch of stock to avoid errors in delivery
- f) More automation to avoid too many people handling the same paperwork
- g) “Reliable information systems are dependent on accurate input of information by people. Therefore simple, easy and efficient information systems with clear processes and integration will improve the timeliness, accuracy and reliability of information and reports with as much automated input and documentation as possible”.

For complexities described in Q2.1 a, c, d, e and f the warehouse management and transport management systems offer a strong solution as indicated in the literature. These being integrated with an ERP including MRP and sales analysis and forecasting tools will further assist with Q2.1 a, b, c, d, e f and g. Vlčková (2008) and Kannegiesser, et al. (2009) suggested that using these tools, especially in conjunction with network partners, will improve stock level management, reduce stock obsolescence, as noted in internal business challenges (Q1.2 iii) h) and assist in hedging against the foreign exchange volatility noted in the supply side challenges (Q1.2 ii) d. The flexibility of the setup of the integrated ERP systems for document printing and management, numerical sequences, automated reports and alerts enables the reduction of manual documentation and handling noted in Q2.1 f. To assist with Q2.1 g, the strength of training noted in Q1.5 k above and Q3.1 h under HR aspects below is noted. The use of ISO procedural documents is further indicated for this by its high score for

being properly run and monitored (88.73%) and effectiveness (78%) in the quantitative data Q16.

Qualitative question 2.2: Information system technologies to assist in best practice logistics implementation

A summary of the information technologies mentioned by the subjects includes:

- a) Good stock management system with stock movement reporting
- b) Vehicle tracking and load planning, automated trip sheets and route management system
- c) Automated certificate of analysis and hazardous chemical document production
- d) Customer relationship management system including customer usage analysis
- e) Sales and stock forecasting system
- f) Online customer complaints and compliments system
- g) Effective communication systems
- h) An MRP system

The low level of input given to this question correlates to the assertion that the chemical distribution sector has a low level of technology adoption or knowledge of technology tools and information solutions available for improved efficiency in logistics. Q2.2 a, c, d, e, and h are usually included in a top or middle tier integrated enterprise resource planning information system, such as SAP, Oracle, Infor, Syspro and JD Edwards. The items in Q2.2 b and c will be included in an integrated Transport Management System. Q2.2 f and g are included with ERP's that have a Business to Customer (B2C) or Business to Business (B2B) interface/portal. The frequency of adoption rates for the aforementioned technologies is seen in the quantitative data Q18 below.

Quantitative questions 3, 7 and 9 Acceptance of technology and information systems for improvement of logistics

The statements in table 4.6 seek to quantitatively confirm acceptance of technology and information systems for improvement of logistics efficiency.

Table 4.6 Acceptance of Technology, Information systems and Networking

OBJ	QUEST	STATEMENT	Mean Score			
			Cust	Dist	Supp	Sample
2	Q03	Technology can assist in improving efficiency in logistics systems	4.39	4.45	4.82	4.56
2	Q07	Networking with other organisations improves logistics efficiencies	3.83	3.76	3.59	3.73
2	Q09	Effective information flows are important for movement of inventory	4.56	4.74	4.59	4.63

In table 4.6 for Q03 at a sample mean of 4.56/5 (91%) acceptance of technology is good, but customers lag slightly behind the rest, correlating to the low adoption rates for technology and information systems in quantitative Q17 and Q18. The literature referred to networking on a physical organisation to organisation and personal (relationship) level and to networking through technology. The higher rating by customers for networking here possibly reflects more the physical and relationship level than technology as reflected in their low technology adoption rate. Effective information flows here refers both to physical and technology/information system. In the qualitative data collected communication and information flow were constantly referred to by distributors, only once by suppliers and not by customers, which correlates with the distributors' higher rating for effective information flow for effective movement of inventory. The distributor rating 4.74/5 (94.76%) correlates to the Barloworld (2012) research findings that the information flow objective was strongly supported where supply chain competitiveness is critical to success. Baker (2011) asserted that chemical distributors need efficient information flows and information technology infrastructure to provide a value added service to the suppliers and end customers.

Quantitative question 18: Implementation rate of identified information systems

Subjects indicated which of the identified information systems technologies (IST's) are implemented in their organisation to enable logistics efficiency improvements, which is reflected in Table 4.9

Table 4.9 Frequency rate of implementation of information system technologies

Code	% Implementation	ALL	Cust	Dist	Supp
ERP	Integrated Enterprise Resource Planning	30%	24%	33%	41%
CRM	Customer Relationship Management	31%	20%	42%	35%
IRP	Inventory Replenishment planning	45%	36%	58%	41%
WHS	Warehouse Management Systems	36%	25%	42%	59%
PP	Production Planning	37%	53%	20%	29%
B2B	Business to Business Order processing	25%	19%	31%	29%
TM	Transport Management	30%	24%	33%	41%
OVM	Online Vendor Managed Inventory	12%	7%	11%	35%
IB	Internet Banking	77%	73%	84%	71%
BA	Basic sales and accounting	71%	69%	78%	59%
OTH	Other	0%	0%	0%	0%
	Mean	36%	32%	39%	40%
	Correlations		Cust:Dis 82%	Dist:Supp 85%	Cust:Supp 72%

In table 4.9 the mean for implementation of Information System Technologies (IST) by the sample population is very low at 36% with a standard deviation of 0.49. There is a stronger correlation between suppliers and distributors (85%) than between distributors and customers (82%). The most frequently implemented IST's are Internet Banking (IB) (76.86%), Basic Sales and Accounting (BA) (71.07%), and Inventory Replenishment Planning (IRP) (44.63%). The split of implementation of IST's between categories is illustrated in figure 4.16. The codes in table 4.9 are used due to space constraints.

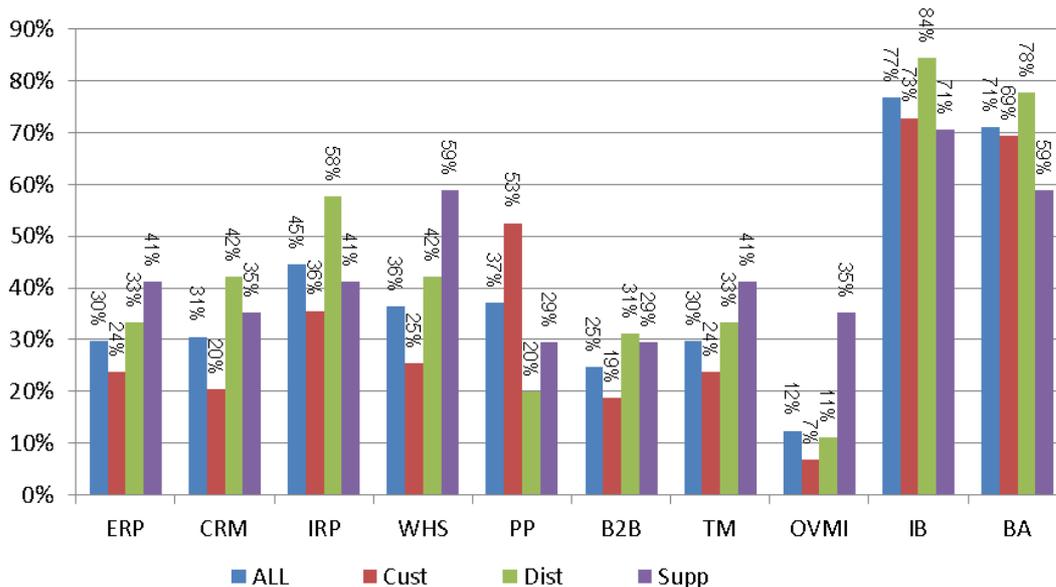


Figure 4.16 Frequency of implementation of IST per category

Figure 4.16 illustrates the significant difference in implementation rate of internet banking (IB) and basic accounting (BA) over the rest. The next most implemented systems are inventory replenishment planning (IRP) (also referred to in literature as materials resource planning (MRP) in a production environment) (44.63%), production planning (PP) (37.17%), warehouse management systems (WHS) (36.36%) and customer relationship management (CRM) (30.58%). Distributors are the strongest adopters of IB, BA, IRP, CRM, and business to business (B2B), while suppliers are the strongest adopters of WHS, transport management (TM), enterprise resource planning ERP and online vendor managed inventory (OVMI). Customers are the strongest adopters of production planning (PP) which can be integrated with IRP to assist in demand forecasting, yet the adoption rate of this is low (36%) and the qualitative data noted the Distributors difficulty with customers' unpredictable demand. Distributors lead in the adoption of IRP (13% above the mean) correlates to qualitative data Q1.1 need for on time delivery and availability of inventory, and Q15 availability of inventory the most desired element of service.

The distributors' lead in CRM (12% above the mean) correlates to the 1st ranking of customer service excellence for drivers for logistics efficiency improvements. The gap between distributors and suppliers for WHS (17%), TM (8%), and ERP (8%) indicates an opportunity for further adoption of these IST's to improve logistics. The suppliers' variance (24%) for OVMI is relates to supply of bulk tank goods with constant demand patterns. The distributors' low rate for TM (33%) and WHS (42%) does not correlate to the stated complexities of flow of goods in and through the warehouse and management of transport logistics noted, or to the technology solutions and best practices recommended in the qualitative data. The qualitative data further noted challenges related to matching capacity of trucks to size of loads and orders. This reinforces the opportunity for further adoption of these technologies.

Question 18.2: Cost of implementation of identified information systems

Due to the cost competitiveness of the sector the subjects were asked to rate the IST's out of 5 for cost of implementation. Figure 4.17 reflects the overall rating for cost of implementation.

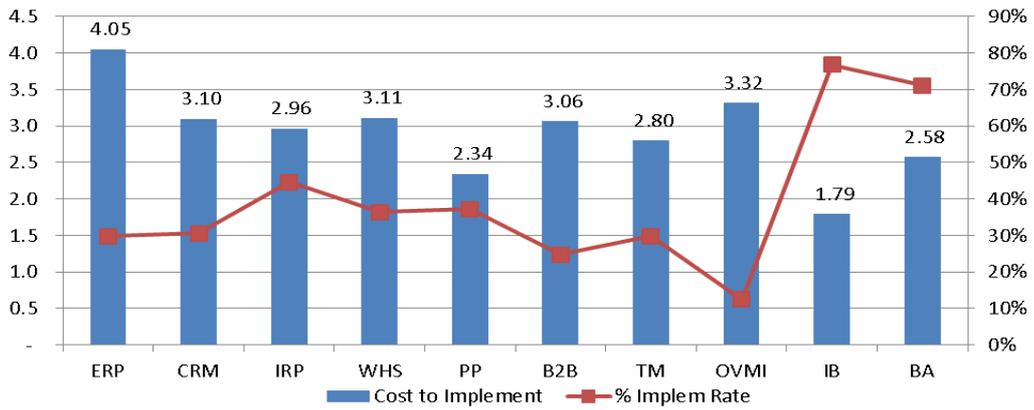


Figure 4.17 Average rating for cost of implementation vs rate of implementation of IST's

Figure 4.17 reflects that ERP's 4.05/5 (81.03%) are the most costly to implement, followed by OVMI 3.32/5 (66.32%), WHS 3.11/5 (62.17%) and B2B 3.06/5 (61.25%) systems. The mean for all IST's is 2.65/5 (53%) with a standard deviation of 1.59. There is a 70% correlation for cost to implement and frequency of implementation. ERP integrates to BA, IRP, and CRM, and can also include IB, B2B, OVMI and WHS depending on budget and capacity for handling the complexities involved. This reflects in the variance of 23% for ERP cost.

Question 18.3: Rating of information systems for effectiveness

To identify technology for improvement of logistics efficiency subjects were asked to rate the IST's out of 5 for effectiveness, with the averages shown in Figure 4.18.

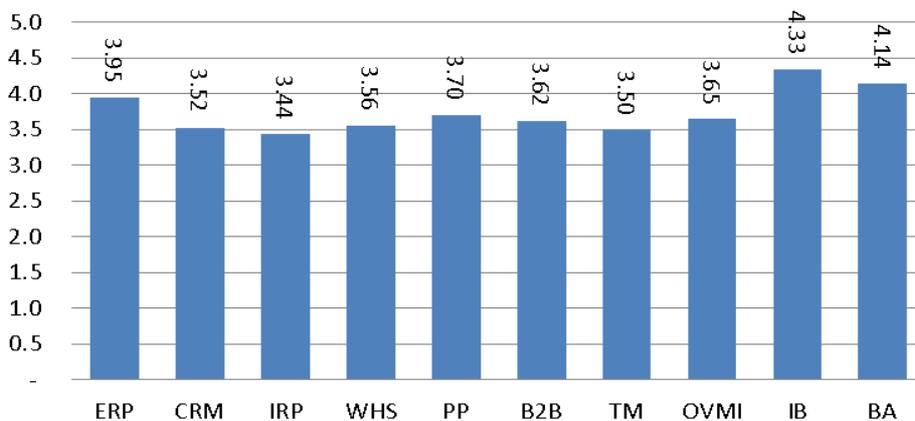


Figure 4.18 Average rating of information system technologies for effectiveness

In figure 4.18 internet banking (IB) 4.33/5 (86.67%), basic accounting (BA) 4.14/5 (82.82%), enterprise resource planning (ERP) 3.95/5 (78.97%), production planning (PP) 3.70/5 (74.04%) and online vendor managed inventory (OVMI) 3.65/5 (73%) are rated the top five IST's for effectiveness. All except for inventory replenishment planning (IRP) (68.80%) are rated higher than 70%. Although the standard deviation for the sample is 2.0, correlations between the categories of subjects for effectiveness ratings are above 94%. The correlation between frequency of implementation and rating for effectiveness of IST's is 74%, while the correlation between cost and effectiveness is only 41%. Correlations are illustrated in figure 4.19

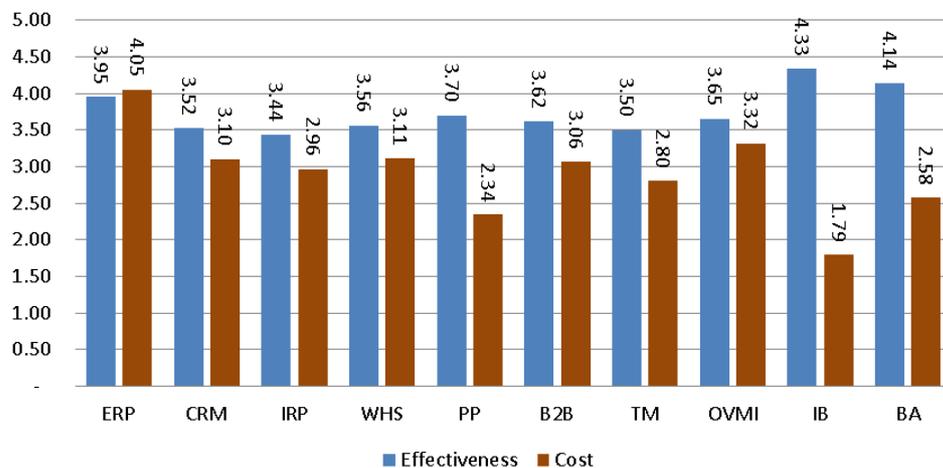


Figure 4.19 Rating for effectiveness of IST's vs cost of implementation

Figure 4.19 indicates a weak correlation between cost and effectiveness for IB and BA. Excluding these the overall correlation for the rest of the IST's is 60%. There is a strong correlation for ERP's for cost and effectiveness and a good correlation for this for CRM, IRP, WHS, B2B and OVMI, indicating a worthwhile investment for the IST's for logistics efficiency improvements in the chemical distribution sector.

Quantitative question 18.4: Rating of information systems for reliability

Distributors depend on the reliability of information systems to assist with best practices. This is strongly stressed in the qualitative data collected: Q1.1f, Q1.2ii)a, Best Practice Q1.3n, technology supporting logistics Q1.4k, underpinning best practice Q1.5g and Q2.1g IST solutions for complexities. The subjects rated each IST out of 5 for reliability, with the average ratings illustrated in Figure 4.20

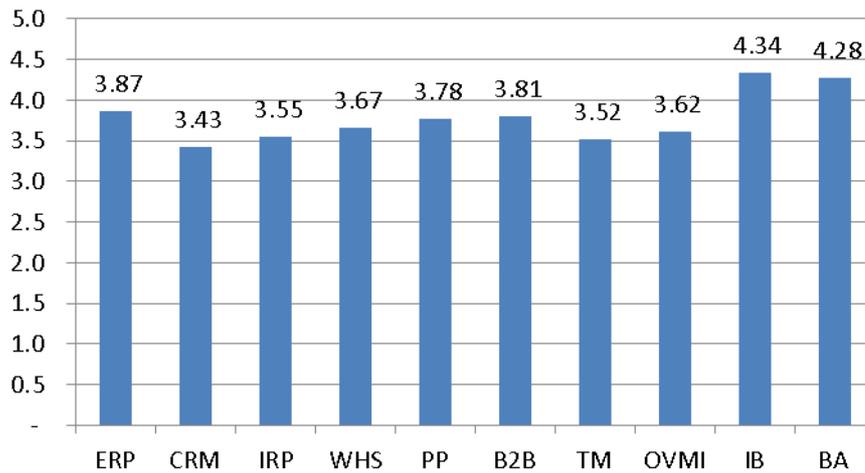


Figure 4.20 Average rating of information system technologies for reliability

In figure 4.20 the five most reliable IST's are internet banking (IB) (86.89%), basic accounting (BA) (85.61%), enterprise resource planning (ERP) (77.44%), business to business (B2B) (76.13%) and production planning (PP) (75.51%). The standard deviation for the ratings is 2 and the overall correlation between all categories is above 95%. All IST's score above 3.4/5 (68%). There is a 95% correlation for reliability to the effectiveness of the IST's and an 80% correlation between the reliability and frequency of implementation. Table 4.10 illustrates the difference between the average of the effectiveness and reliability ratings for each IST and the implementation rate.

Table 4.10 Average rating of IST's for effectiveness & reliability vs implementation

Average rating for Information system technology vs implementation rate			
Code	Information System Technology	Ave Rate	Implemt
IB	Internet Banking	86.78%	76.86%
BA	Basic sales and accounting	84.22%	71.07%
ERP	Integrated Enterprise Resource Planning	78.21%	29.75%
PP	Production Planning	74.78%	37.19%
B2B	Business to Business Order processing	74.24%	24.79%
OVMI	Online Vendor Managed Inventory	72.69%	12.40%
WHS	Warehouse Management Systems	72.27%	36.36%
TM	Transport Management	70.24%	29.75%
IRP	Inventory Replenishment planning	69.82%	44.63%
CRM	Customer Relationship Management	69.52%	30.58%

The gaps between the high average ratings of IST's versus the low rate of implementation in table 4.10 indicates opportunities for further adoption of these

for the chemical distribution sector. With reference to the qualitative data the IST's that could specifically improve logistics efficiencies, but have low implementation rates are WHS, TM, IRP, OVMI, B2B, and CRM.

4.5.3 Objective 3:

Determining what Human Resource and training aspects must be considered

Qualitative question 3.1: Skill sets needed in order to support logistics operations

The collated and summarised skill sets identified by the subjects are:

- a) Qualified and experienced staff with skills in procurement, negotiation, shipping, modern automated warehousing and transport scheduling.
- b) Good knowledge of relevant legislation
- c) Excellent planning and communication skills
- d) Strong stock, warehouse, storage and stacking management skills
- e) Understanding of cost drivers and the management and tracking thereof
- f) Good people management skills
- g) Knowledge of and understanding customer needs and expectations and what customer service excellence means
- h) Computer literacy
- i) Good basic education and literacy, reading, writing and arithmetic
- j) Knowledge of the chemical industry and the products
- k) Supply chain management
- l) Knowledge of Hazchem, fire fighting and safety aspects of the business
- m) Properly trained and qualified forklift drivers, truck drivers and assistants
- n) Proficiency in logistics and distribution and how it works – understanding the flow of things, ability to see the big picture
- o) Systems and process management skills
- p) Understanding and effective implementation and running of ISO quality standards procedural system

The above identified skill sets correlate to the data collected for objectives 1 and 2 and the information discussed in the literature review in this regard. However they give more insight into the South African chemical distribution sector context. Given the identified skillsets required in Q3.1 a, b, c, d, e, k, n, and o above and the core capabilities listed in Q3.2 a, b, c, d, e below there is incongruence to the quantitative Q19 results below for use of diplomas or degrees (22.31%), formal training programs (37.19%), study loans (28.93%), bursaries (15.70%), and career path training (11.57%). Considering that employing for talent (24.79%) is so low, it is assumed that companies are not employing individuals who already have these skills. Furthermore for Q3.1 i, a higher frequency of use of learnerships (30.58%) and adult basic education (15.70%) in the sector would be expected. It is noted that Ittmann and King (2011) included skills shortages and insufficient collaboration in their reasons for the high total cost of logistics in South Africa. (Hayes, 2004) noted that skills and knowledge are now more important than physical assets and Valk (2011) reported that chemical distributor, Hubbard-Hall is spending more on employee training and identifying necessary skills than on infrastructure and trucks. It will be seen from the quantitative data that this area needs further focused attention from the sector.

Qualitative question 3.2: Core capabilities required for efficient logistics in chemical distribution

Understanding core capability requirements will define what core competencies are needed. This will assist in identifying the underlying skillsets, knowledge, abilities management tools, HR strategies and employee development tools needed to develop the core competencies. A summary of the core capabilities identified by the subjects is as follows:

- a) Dedicated, educated and experienced employees in key performance areas affecting actual and perceived service levels
- b) Skill and ability to move inward and outward flows of high volumes of products in varying sizes of order quantity
- c) Efficient load planning, monitoring and management and fleet capacity utilisation management
- d) Effective international and local supply chain management

- e) Effective inward logistics and supply lead time management for accurate availability forecasting and promises to customers
- f) Product knowledge and understanding of their uses, for storage, handling, delivery and customer technical support
- g) Efficient order taking, processing, document handling, information, process and goods flow for quick turnaround time with on time and in full deliveries without errors
- h) The ability to develop relationships, explore opportunities and implement them for the benefit of customers and the organisation

The use of technology, information systems and management tools for the above core competencies has been shown in the previous sections. The above core competencies correlate Halley and Guilhon's (1997) assertion that strategy relies on human resource management and the development of core competencies for logistics. Q3.2 b, c, d, e, f, g and h reinforce the views of Hayes (2004) and Rainbird (2004) that firms need to assess and reengineer their core processes and capabilities to link their activities into the greater structure of networked business value chains as customer retention through excellent, responsive service becomes ever more essential. This links in with Baker's (2011) report of suppliers and distributors working closely together to improve product knowledge and customer service delivery. There is correlation between these points and the quantitative data Q07, networking with other organisations improves logistics efficiencies (74.54%) and Q09, effective information flows are important for movement of inventory (92.57%).

Qualitative question 3.3: Presence of the necessary skills to cope with technology implementation

If technology solutions are sought to enable logistics efficiency improvements it is important to know if managers and employees in the companies have the necessary level of education, knowledge and literacy to cope with the implementation of identified technology solutions:

- a) The majority of subjects felt that there was an insufficient level of education, skill and ability on the part of management for technology implementation

- b) Some noted that while managers may have the necessary skill and education employees do not.
- c) Some responded that some do and some don't
- d) It was noted that extensive training is needed to improve skills in this area

Qualitative question 3.4: HR strategies needed to have the correct skillsets and organisational structure for customer satisfaction

The following collated summary of HR strategies was identified by the subjects:

- a) "The HR function seated at top management level and of a high calibre to correctly interpret areas requiring strengthening and able to influence company policy to implement sound recommendations for recruitment and training"
- b) HR involved in understanding reasons for poor company performance, customer satisfaction, buying and stock control issues and assisting in making necessary adjustments
- c) Management with good organisational skills
- d) Have the right people in the right jobs
- e) Proper screening and literacy testing at the recruitment stage and employment of people with the correct experience and qualifications for the level of employment.
- f) Employ team players with the right attitude
- g) Salary surveys, fair remuneration and packages that lure good talent and suitably skilled people
- h) Skills gap analysis for existing to desired skills, development plan to close the gap, key performance indicators, performance evaluation and good rewards system
- i) Strategies that identify key employees and skillsets and ensure good quality, on-going training and continuous development
- j) A strategy that develops staff to deal effectively with customers, truthfully, intelligently, respectfully and ensures effective customer liaison and customer satisfaction, seen in repeat orders
- k) Good downward and upward communication and feedback

- l) Effective employee review and performance management programs; employees knowing what is expected of them and correct counselling and discipline procedures to adjust poor performance
- m) Use of ISO Standards and non-conformance reports to ensure corrective action
- n) Effective on the job training and outside training programs of which employees are aware
- o) Employees clear on the company structure and understanding the organogram, reporting lines, processes and procedures
- p) Encourage a learning and knowledge development culture in the organisation
- q) Use of employee surveys

The above points give useful insight into the initiatives required to support the objectives of this study. There is a strong alignment to the literature reviewed relating to human resources and skills. The reference to performance management and employees understanding what is expected of them highlights the need to use the Q16 management tools such as performance measurement, bench marking, process mapping, process reengineering, standardisation, ISO procedures, Six Sigma and customer satisfaction surveys to strengthen performance with the use of the identified skills development methods referred to in the literature and examined in the quantitative data.

Qualitative question 3.5: Other human or physical aspects to be considered for effective logistics for customer service

A summary of the open ended responses from subjects highlighted these aspects:

- a) Peak traffic congestions; warehouse operating parameters of clients
- b) “Customer service perceptions are heavily influenced by physical appearances so clean, modern vehicles, delivery vehicles must be aesthetically pleasing, packaging and even office accommodation convey the image of efficiency”

- c) Vehicles which meet the legal specification for the deliveries undertaken, with correct equipment and signage, tail lifts, fire extinguishers, Transport Emergency Cards etc.
- d) Physical location of the business to customers and suppliers
- e) Budget limitations for competent staff, good infrastructure, resources and stock availability
- f) Having sufficient of the right resources to improve efficiency and turnaround times. Loading and offloading equipment, warehousing, racking, dispatch and receiving areas, vehicle access, holding bay, security, wash bay, spill kit, ventilation and quality control managers
- g) Dedicating certain resources to certain tasks where necessary for streamlining
- h) Resource capacity sufficient to allow for growth in the business
- i) Relationship skills and flexibility
- j) Competent staff is key to success of the company as they portray an image of the company
- k) Understanding of the company distribution strategy; deliver good service, strive to do better, maintain your vision, make it your mission
- l) The fewer mistakes made from Customer – Sales – Deliveries the more efficient logistics and the rest of the company will be.
- m) Have the right attitude to the customer and ensure quick responses to queries and complaints and continual feedback
- n) Managers and supervisors with knowledge to guide people and empowering staff to fit the needs of the business
- o) Employing staff with ability to speaking a number of languages to improve third party communication due to the 11 official languages in South Africa
- p) Ensure understanding of customer requirements and deal with bad attitudes towards service excellence immediately.
- q) Deal with constraints of delivery resource availability at peak times, difficulty in delivering at customer premises due to location or driveway/ yard size, and customers not fully understanding their own requirements and product uses.
- r) Open telephone lines that are answered timeously

- s) Effective use of accounting systems to reduce customer frustration either on the telephone or collecting
- t) Pleasant working environment, customer friendly & safe office space

A number of the above points are covered in the business operations and logistics operations management sections of the literature review and correlate to the views expressed by the authors. The profile of the South African chemical distribution sector is more clearly revealed in these points. The emphasis on skills, knowledge, attitude of employees and resource availability are highlighted again. New emphasis on appearance, reputation, flexibility, empowerment, relationship and responsiveness for company growth is revealed in the subjects' responses to this question, which add weight to the readings from Mentzer and Williams (2001), Gattorna (2007), Bowersox (2008), Hall (2010), Christopher (2011) and others regarding the impact that these aspects of efficient distribution and logistics can have on customer service and the success of the organisation.

Quantitative questions 4, 5, 6, 8, 10, 11 and 12: Organisation structure, employee effectiveness, training impact, and skills availability

The statements in table 4.11 seek to establish the impact of human resources, training and employee effectiveness on, and assess availability of skilled resources for logistics efficiency.

Table 4.11 Effects of structure, human resources and training on logistics.

OBJ	QUEST	STATEMENT	Mean Score			
			Cust	Dist	Supp	Sample
3	Q04	Structure of organisation and departments will impact on logistics efficiency	4.42	4.31	4.53	4.42
3	Q05	Effectiveness of individual employees' impacts on Logistics operations	4.66	4.57	4.76	4.67
3	Q06	Training impacts on employee's ability to perform	4.56	4.57	4.65	4.59
3	Q08	Organisation uses multi-functional teams rather than departments	3.46	3.40	3.06	3.31
3	Q10	Adequately skilled workers for warehouse operations easy to find	2.68	2.38	2.24	2.43
3	Q11	Adequately skilled workers for transport operations easy to find	2.83	2.64	2.47	2.65
3	Q12	Adequately skilled workers for administration easy to find	3.15	3.07	2.94	3.06

In table 4.11 the average rating for effectiveness of individuals is higher at 4.67/5 (93%) than the rating for the structure of the organisation and departments at 4.42/5 (88%) for impacting logistics efficiency. This is made clear by the 82%

correlation between Q05 effectiveness of individuals and Q06 training impacts employee's ability to perform, the low rating for multi-functional teams used in organisations and the -78% negative correlation between organisation structure and multi-functional teams. In spite of the distributors' average score for Q04 4.31/5 (86.19%) their average 3.76/5 (75.24%) on objective 2 Q07, networking, and Q08 3.40/5 (68.10%) reflect that the importance of total organisation structure, networking with other organisations and multi-functional teams for operating efficiency referred to in the literature (Poirier, 2005; Beesley, 2010; Christopher, 2011), rather than organisations and departments operating in silos with key individuals, have not yet been strongly embraced in the chemical distribution sector. This is further indicated by the distributor 4.57/5 (91.43%) for Q05 for impact of the individual.

The strong emphasis for skilled employees and training needed in the sector noted in the literature and in the qualitative data is re-enforced in the low 2.43/5 (49%) for adequately skilled warehouse workers, Q10, 2.65/5 (53%) for transport operations workers, Q11, and 3.06/5 (61%) for administration workers, Q12 being easy to find. This would explain the reference of some distributors in the qualitative data to the need to outsource and the move by one distributor to outsourced warehousing. Where the majority of customers are using low skilled and manual methods of production and distribution of finished goods their ratings are higher (58% Avg.) for ease of finding skilled workers than those of distributors (54% Avg.). Suppliers, with more sophisticated production and distribution methods and a higher rate of implementation of technology have the lowest Average (51%).

Quantitative question 19: Implementation rate of skills development methods

From the training needs identified in the literature, the subjects indicated which of the identified skills development methods are implemented in their organisation. Figure 4.21 illustrates the frequency rate of implementation of these.

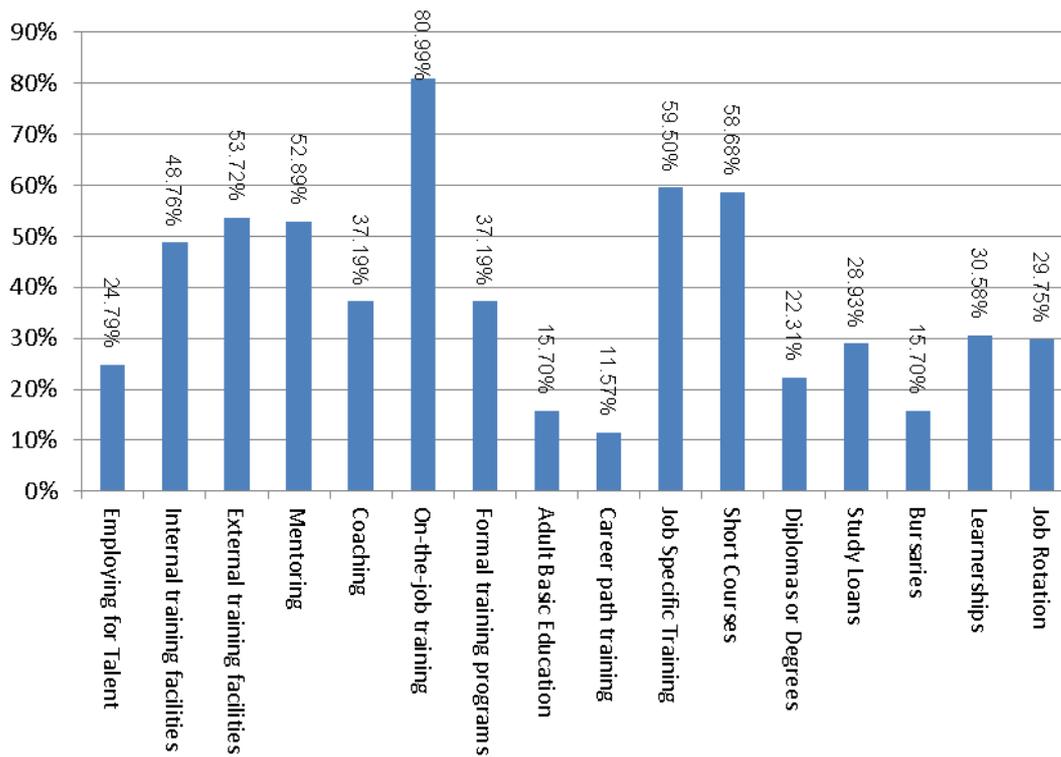


Figure 4.21 Frequency of implementation of skills development methods

In figure 4.21 the most popular methods of skills development are on the job training, job specific training and short courses, followed by external training facilities, mentoring and internal training facilities. It is understood that in some cases these methods are used in combination. These statistics align with the Barloworld Logistics (2011) SupplyChainForesight survey which revealed that the majority of skills were developed within organisations. The mean rate for all methods is 35.78% with a standard deviation of .49 for the sample.

As with the frequency of implementation of technology customers lag behind suppliers and distributors in use of methods of skills development with a mean of 30.61% (5.17% below the sample mean). The correlation between customers and distributors is stronger here than between distributors and suppliers and between suppliers and customers. The split of usage of methods per category is illustrated in figure 4.22. Codes for each method are used here for space constraints.

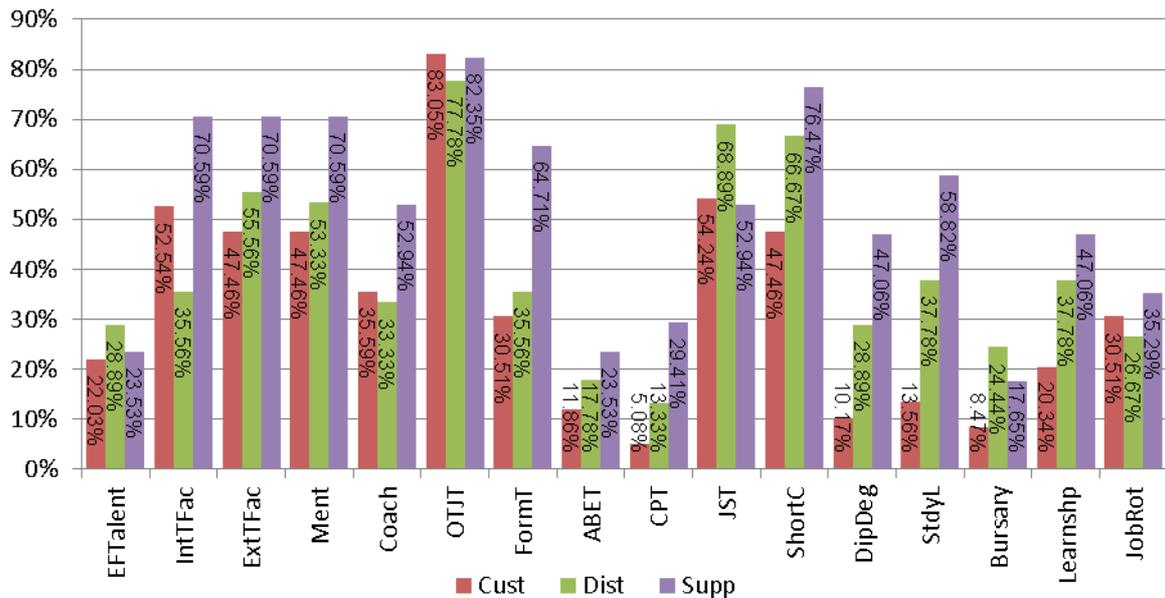


Figure 4.22 Frequency of use of methods of skills development per category

It is noted in figure 4.22 that for all but three methods of skills development, employing for talent (EFTalent), job specific training (JST) and bursaries (Bursary), suppliers lead the way in skills development method usage (at 48.44% they are 35.39% above the mean). Distributors employ on the job training (OTJT) (77.78%), job specific training (JST) (68.89%), short courses (ShortC) (66.67%), external training facilities (ExtTFac) (55.56%) and mentoring (Ment) (53.33%) methods the most, followed by study loans (StdyL), Learnerships (Learnshp), internal facilities (IntTFac), formal training (FormT) and coaching (Coach) all above 30% frequency. Given the reference in the literature and qualitative data to need for basic literacy and adult education and the need for special skills in supply chain, planning and logistics a higher frequency of usage of adult basic education (ABET), diplomas and degrees (DipDeg) and EFTalent would have been expected. JST and OTJT is effective for lower levels of employee in the warehouse and internal sales. ShortC are cost effective for supporting these.

Quantitative question 19.2: Effectiveness of skills development methods

To gauge the effectiveness of the methods of skills development for improvement of efficiencies for logistics the subjects rated the methods of skills development out of 5 for effectiveness. Figure 4.23 illustrates the correlation between overall rating for effectiveness and the frequency of use of the methods.

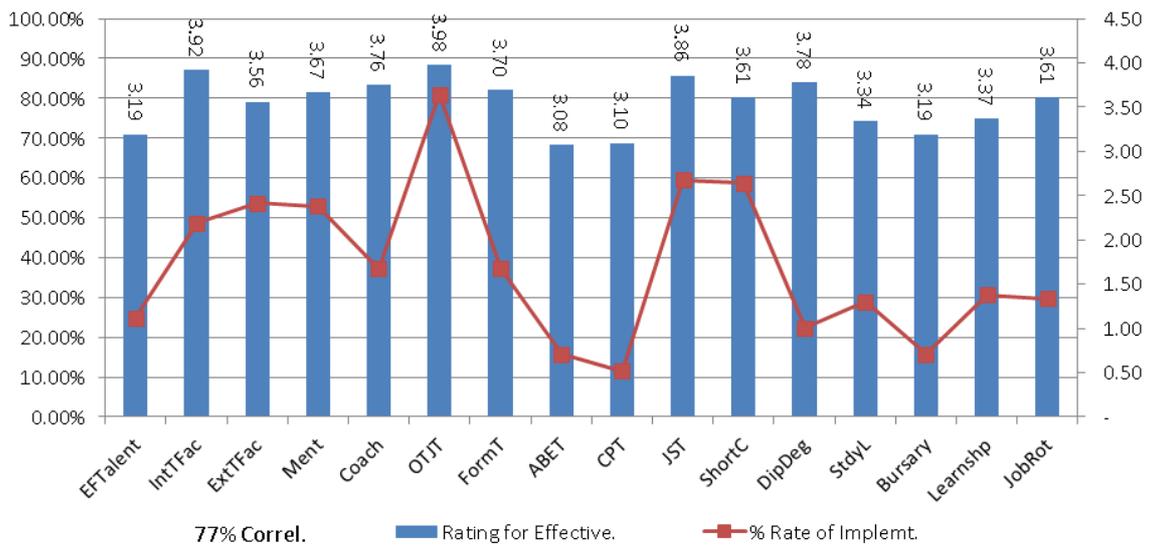


Figure 4.23 Rating for effectiveness and correlation to frequency of usage of methods of skills development.

Figure 4.23 illustrates a 77% correlation between rating for effectiveness and frequency of usage with a standard deviation for rating for effectiveness of 1.91. The correlations between the categories for effectiveness are all above 82%. The methods most highly rated for effectiveness are OTJT 3.98/5 (79.58%), IntFac 3.92/5 (78.36%), JST 3.86/5 (77.18%), DipDeg 3.78/5 (75.63%) and Coaching 3.76/5 (75.10%). FormT, Ment, JobRot, ShortC, ExtTFac, Learnshp and SdyL all score above 65% for effectiveness. The reason for the negative correlation between frequency of usage and rating for effectiveness for DipDeg (22.31%: 75.63%), Coach (37.19%: 75.10%) and FormT (37.19%: 73.91%) is most probably related to the cost of these methods. JobRot is not expensive and is rated at 72.20% for effectiveness and only 29.75% for usage, revealing a possible area of further usage for skills development. The Barloworld (2011) survey shows this as a popular method of skills development. It is noted that this survey also showed trainee management development programs to be strongly employed, yet the employment rate of its equivalent here, career path training (CPT) (11.57%) and its rating for effectiveness (61.90%) are low by comparison. This is incongruent with the required skillsets identified in the qualitative data objective 3 Q1. From the high level of agreement to quantitative Q5 and Q6 relating to effectiveness of individuals and the impact of training for improved logistics, and at the effectiveness rating of identified skills development methods they appear to be

strongly applicable in the chemical distribution sector for improvement in logistics efficiencies.

4.6. Conclusion

In this chapter the findings of the data collected from the qualitative and quantitative research instruments were presented through descriptive and inferential statistics, tables and figures. Graphs were used to analyse and illustrate the information from each question as related to the different objectives stated at the beginning of the chapter. In most cases the findings in the quantitative data supported those of the qualitative data and related to the research undertaken in the chapter 2 literature reviewed. Areas for improvement by the distribution sector were identified. Chapter 5 will detail the recommendations from the data analysed from chapter 4 (combined 4 and 5).

CHAPTER FIVE

RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

From the preceding chapter four (combined chapters 4/5), the presentation and discussion of research results were related to the stated study objectives. Chapter five will discuss recommendations and conclusions and bring the study to a close. It will highlight the benefits of the research undertaken and state whether the data collected answered the research questions. The chapter will further look at limitations of the study and identify areas for further research.

5.2 Has the data answered the research question?

From the stated objectives the research questions to be answered were:

1. Can logistics best practices be identified that will improve chemical distributors' logistics operation efficiency and customer service?
2. What information systems and technologies will assist in best practice logistics efficiency?
3. What human resource and physical aspects need to be considered to implement further logistics best practices and technologies for optimal customer service?

The above questions have been answered through the literature reviewed, the qualitative data collected, analysed and summarised and the quantitative data analysed and discussed through inferential and descriptive statistics in chapter four.

Question 1 was answered through identification of business operations, networked business, logistics and supply chain concepts. Best practices identified for logistics efficiency improvement through understanding customer needs and buying behaviours and structuring of supply chains accordingly, use of management tools, such as, inter alia, demand forecasting, performance measurement, continuous improvement, ISO Quality systems, and advanced shipping notices.

Further best practices for the management of warehouse and transport functions for efficiency identified were, inter alia, warehouse receiving, storing, labelling, marshalling and dispatch practices, load planning, truck capacity maximisation, and the extra distance measurement tools.

Question 2 was answered with the identification of inter alia, integrated enterprise resource planning (ERP), customer relationship management, inventory replenishment planning, warehouse management, business to business order processing, transport management, and online vendor managed inventory systems, bar coding, batch tracking, hand held scanning devices, automated inventory counts, radio frequency identity tags, automated picking equipment, voice activated devices and an analysis of their applicability in the South African chemical distribution sector.

Question 3 was answered through identification of the skillsets required for efficient logistics, discussion of the concept of core competencies required, and the further physical and human resource aspects required for efficiency improvements. This was further supported by identification and analysis of the skills development methods, such as inter alia, on-the-job training, internal training facilities, job specific training, diplomas or degrees, coaching, formal training programs, mentoring, job rotation, short courses, and external training facilities, and their effectiveness.

5.3 Benefits of this research

From these answers to the research questions the chemical raw material distributors are shown key areas of best practices, information systems, technologies and human and physical aspects that will assist in improving their logistics and distribution to their customers. The further illustration from the literature, qualitative and quantitative data, of the requirements for the networked relationship with, and service provided to suppliers, who are the producers of the chemical raw materials distributed by them, will assist the distributor and supplier in improving the interfaces between their organisations for better logistics to the end customer and sustainable competitive advantage. The customers will benefit from the improved efficiency that will come about when distributors embrace and

implement more of the identified best practices, and management tools, technologies, information systems and skills development methods. The distributors will further benefit from selling the advantages of these to their customers and encouraging their adoption of best practices and technologies. This would improve their own efficiencies, the demand and supply forecast accuracy, capacity and resource planning and allocation, overall service to the customers, competitive advantage and profitability of the distributors and customers.

5.4 Recommendations to solve the business problem

5.4.1 Best practices to improve logistics efficiency for customer service

5.4.1.1 Business operations and value chain recommendations

From the literature reviewed it has been shown how imperative it is for chemical raw material distributors to leverage their logistics operations for sustained competitive advantage (Mentzer and Williams, 2001; Engel and Roof-Broihan, 2006; Baker, 2011; Eberhard, 2012). From the research results, the key drivers for logistics improvements are ranked by the sector in the following order of importance:

1. Customer Service Excellence
2. Competitive advantage
3. Maximising profits
4. Reduced Lead times
5. Maximising use of people & assets
6. Reduced inventory holding

The following are the relevant and practical recommendations based on the findings of the research and literature reviewed:

Structure of organisations and departments was rated highly for impact on logistics efficiency (86.19%). It is asserted that the first step to running efficient logistics is to identify the company vision, strategy and objectives and the flow down to operational processes and requirements, as discussed in the performance pyramid concept (Gattorna, 2003). Then analyse the value chain “primary activities

of inbound logistics, operations, outbound logistics, marketing and sales, and service, and the supporting activities of procurement, technology development, human resource management and firm infrastructure” for efficiency, effectiveness and cost, versus value creation and profit maximisation (Porter, 2005). Further effort will strive to understand the linkages between the activities for networking, breaking down of silos, flow through of information and processes, improvement of speed, containment of costs and understanding strengths and weaknesses in the organisation as a whole. Using this analysis will assist the distributor to restructure the business, adjust their business model and reengineer processes to improve logistics efficiency, to maximise customer value creation and service excellence, strengthen competitive advantage and maximise profits (Porter, 1985; Rainbird, 2004; De Villiers, Nieman and Niemann, 2010). Value chain analysis and the following business tools can assist in establishing the correct structure and process improvements for logistics efficiency.

From the literature and data analysis the following best practice business management tools are recommended to assist in the analysis, adjustment and re-aligning, management, and control of the processes and operations in the organisation, warehouse, distribution and logistics functions:

1. Performance measurement – identify the measurable components and the required standards and measure the outcomes against performance objectives. This relates to people, physical resource and process management (Gattorna, 2010b; Johnson and McGinnis, 2011).
2. Continuous Improvement – identify the key performance areas for optimal logistics efficiency and detail them for constant measurement and incremental improvements (Nickel, 2006; Bowersox, 2008; Angelis, Conti, Cooper and Gill, 2011).
3. ISO Procedures – set up the ISO quality system in the organisation, with defined processes and document flows necessary for the completion of the different tasks involved. Then use the non-conformance reports and perform the necessary internal procedural audits to ensure compliance to set processes and quality standards (identified in the qualitative data and administered by the researcher within a chemical distribution organisation).

4. Customer Satisfaction Surveys – at least every 6 or 12 months conduct a customer satisfaction survey to assist in the identification of areas for improvement or adjustment of logistics processes, infrastructure or standards to ensure continuous fulfilment of customer needs and competitive advantage. This eliminates hubris, relying on internal perceptions and interpretations and relying on past successes rather than current circumstances to understand the what, when, where, and how of doing things right for competitive advantage (House, 2004; Grant, 2010).
5. Bench Marking – establish organisational, divisional, departmental, and market related bench marks for the various performance areas of the distribution and logistics operations, such as delivery turn-around time, supply lead times, maximum delivery capacity, warehouse and fleet performance, standard cost models and the like. Agree set bench mark standards. Measure the outcomes against set standards and use the assessment results to earmark areas for improvement (Straube, Nagel and Rief, 2010; The Descartes Systems Group Inc., 2012).
6. Process Mapping – understanding the flow of processes for physical movement of goods, information, documentation and people, time taken, resources required and tasks to be performed. This is often laid out in a schematic or a diagram for ease of visual comprehension and supports ISO implementation, process reengineering, bench marking, time compression, lean methodology, and six sigma. Use process mapping to understand where the organisation's processes tie into processes of networked organisations (Beesley, 2010; Christopher, 2011).
7. Process Re-engineering – identify where processes are weak, cumbersome or ineffectual and seek to identify better ways of doing the tasks with fewer resources and in a more streamlined and efficient manner. Using the information established, redefine the way of doing things in written processes (Rainbird, 2004).
8. Time Compression – identify the non-value-adding activities and processes, duplication of work and documentation and eliminate them to have fewest touches, less risk of error and shortest time frames possible for the quickest ultimate turn-around time from identification to fulfilment of a need. It sets time

based objectives to processes and assists with the required on-time deliveries (Beesley, 2010; Craig, 2012a).

9. Lean Methodology – eliminate handling and all kinds of waste (time, money, resources, people, materials, etc.) and streamline business processes through analysis, re-engineering, standardization, simplification of processes and continuous improvement (Saxena, 2009; Buxton and Jutras, 2006).
10. Standardisation – apply agreed standard volumes, operating procedures, labelling and packaging, capacity, model of trucks, makes of equipment, methods of communication, software implementation, objectives, inter alia, across all departments, divisions and organisations to improve networking, physical flow of goods, documents and information, shorten procurement lead times, implementation, handling, and maintenance times and reduce costs (Buxton and Jutras, 2006; Collins, 2008; Campbell, 2011; The Descartes Systems Group Inc, 2012).

It is important to establish sound processes and measurable key performance indicators for processes, to identify what needs to be done, who needs to do it, and when it needs to be done by, in order to ensure the continued effectiveness of the value chain and meeting of customer needs. This was evident from the strong rating for effectiveness of ISO procedures, continuous improvement, process re-engineering, process mapping, standardisation, customer satisfaction surveys, and performance measurement. The tools that are particularly useful for logistics efficiency improvement and have a low frequency of implementation are benchmarking, process mapping, process reengineering, time compression, lean methodology and six sigma. It is recommended that distributors focus on their implementation. It is noted that in order for any of the aforementioned management tools and best practices to be effective and sustainable they will need to be properly run and monitored. They will require the right organisational structure, top management oversight and involvement and should be implemented and managed by the right people with the necessary mandate, knowledge, skills and resources.

The level of agreement by distributors that networking with other organisations improves logistics efficiencies was 75.24%, and 95.76% agreement that effective

information flows are important for movement of inventory from supplier to customer. Due to the competitive nature of the chemical raw material distribution sector and the constraints on organisations to have all the knowledge, information, capacity, and resources required to meet the needs of producers and suppliers it is recommended that the second step for chemical distributors is to analyse and understand the particular value chain required for their market segments, such as those illustrated by Eberhard (2012) for speciality chemicals and for bulk industrial commodity chemicals. Then, considering the benefits of networking, identify beneficial relationships and establish partnership and networked agreements with suppliers and customers to form their unique supply chain. Work towards ensuring the necessary transparency, professionalism, communication and information flow, technical capabilities and information technology infrastructure to provide a value added service to the end customer (Christopher, 1992; Baker, 2011). Understanding the importance of reliability and best practices identified in the qualitative data and literature, it is important to design and operate contracts that bind the organisations together. These contracts should define the scope and boundaries of the relationships, establish service level agreements, define key performance areas, performance measurement standards and methods. Teams should be designed and managed across the network, and the necessary behaviours and resources required by these contracts must be understood. Managers must further utilise the necessary negotiation skills, types of control, incentive and sanction systems to optimise coordination between organisations and maximise the effectiveness of the network (Hayes, 2008; Luo, Xu and Li, 2005).

It is strongly recommended that in the design of the supply chain and logistics infrastructure, distributors take into account the four most dominant buying behaviours of customers, (collaborative, efficient, dynamic and innovative) and identify which are most prevalent in their sector in order to develop a matching array of aligned responses and a package of attributes in their logistics offering that meets their customer needs. This will mean that one of the four generic supply chain designs (continuous replenishment supply chain, lean supply chain, agile supply chain or fully flexible supply chain) will be adopted by the distributor (Gattorna, 2007; Christopher, 2011). A further consideration must be given to the

supply chain risks as perceived by customers and as experienced by the distributors and these must be actively monitored and managed in conjunction with network partners. It is noted that distributors fell 10.50% below the mean for maximising of people and assets, which is required for effective supply chain management and improvement of logistics efficiency. It is therefore recommended that more focus be given to this area through use of the discussed management tools and skills development methods.

Finally, top management must ensure that the allocation of capital, physical and human resources, and the physical location of the business to customers and suppliers, is properly planned and provided to meet the strategic goals of the organisation and achieve logistics efficiencies. This includes sufficient budget for the implementation of technologies and skills development methods to ensure the right technologies and skilled people in the right places, which strengthens the core competencies required by the organisation. The distributor must further ensure sufficient resource capacity, technology and skills to allow for growth in the business. In the design and choices of location, office accommodation, vehicles and packaging consider the customer service perceptions which are heavily influenced by their physical appearances; they should thus be clean, modern and aesthetically pleasing, to convey the image of efficiency.

5.4.1.2 Procurement practices that impact logistics efficiency

The most important key drivers for logistics efficiency, customer service excellence, competitive advantage, maximised profits and reduced lead times make the significance of understanding customer needs in order to correctly identify the correct structure and processes for logistics clear. Customers rank elements of service needed from distributors in the following order of importance:

1. Availability of inventory
2. On time deliveries
3. Lowest price
4. Complete orders
5. Accuracy
6. Short lead times
7. Technical Advice

It can be seen from these key elements of customer service and the key drivers for logistics efficiency that effective procurement practices are necessary to achieve the desired outcomes. From the qualitative data it is strongly indicated that effective demand forecasting and inventory replenishment practices must be employed. Distributors make the most use of advanced shipping notices in the sector. They need to encourage suppliers to make more use of this tool with them in order to smooth their supply chain, improve their accuracy in making delivery promises to customers and prepare warehouse and logistics for incoming goods. Furthermore, if the supplier notifies the procurement department that they are only shipping part of an order, procurement has the advanced notice to try and source the rest of the order elsewhere to meet the customers' volume demanded and supply a complete order in time. The demand forecasting, inventory replenishment and advanced shipping notices will be underpinned by the technology tools recommended in 5.4.2 below.

Further to the 7 needs noted above, the procurement function must consider the need for:

- a) service excellence,
- b) reliability and reputation of the distributor which is impacted by finding reliable and trustworthy sources of supply locally and overseas,
- c) short supplier lead times and supplier delivery efficiencies, with stronger focus on complete orders, to facilitate prompt and complete deliveries to customers,
- d) improved supplier logistics arrangements to meet the distributor and customers' needs,
- e) trend analysis, sales forecasting, planning and re-ordering of stock for accurate minimum stock holding, while ensuring consistency of supply, availability to customers, margin maximisation and profit,
- f) quality product which is fit for the purpose and meets specifications,
- g) a sufficiently broad product range to supply the 'basket of goods',
- h) consolidation of mixed loads to reduce overall stock holding,
- i) products in good condition with good packaging and labelling,
 - o packaging labels should take into account technology used for traceability

- j) good communication, information flow and timely feedback, including advanced shipping notices and expected times of arrival,
- k) correct documentation, certificates of analysis, material safety data sheets inter alia,
- l) problems solved quickly with backup service, which requires supplier support,
- m) technical information that grows knowledge in the sales force and assists with backup service,
- n) correct timing and hedging of import purchases to mitigate exchange rate volatility,
- o) compliance with legislation, and
- p) timing of inbound goods to match demand and facilitate cross-docking

Procurement must ensure effective supplier contracts and service level agreements that enforce short lead times, correct packaging and documentation, correct labelling, good quality product, packaging and service, and problem solving measures with quick response times. They must further ensure timely and accurate information from suppliers. This too will be underpinned by effective use of technology, information system and telecommunication solutions.

5.4.1.3 Warehouse, logistics and distribution operations recommendations

From a practical perspective the warehouse best practices described in the literature review and reinforced in the qualitative data, relating to good planning and management, efficient labelling, marshalling, distance from marshalling points to storing areas, documentation control, use of shelving and racking, cross docking, concurrent picking, observance of occupational health and safety and correct chemical handling standards, constant inter-functional and inter-organisational communication, facilitation of sufficient resources and properly trained employees and managers should be implemented. (Hansen Harps, 2005; Collins, 2008; De Villiers, Nieman and Niemann, 2010). These, coupled with the identified best practice management tools mentioned above and demand forecasting, advanced shipping notices, and JIT inventory management, plus the technologies identified will be key to ensuring the warehouse efficiency required to

facilitate stock availability, on time delivery, complete orders, accuracy, and short lead times.

From the average scores for ease of use, accuracy and cost savings, and the high acceptance rate that technology can improve logistics efficiency, the technologies of bar coding, batch tracking and hand held scanning devices are clearly indicated and recommended for implementation in warehouses. This will ensure speed and accuracy and traceability of inventory, as well as real time information and transparency of data throughout the organisation. While it is understood that these may be more costly and sophisticated technologies, further consideration of the benefits derived from automated inventory counts, radio frequency identity tags, automated picking equipment and voice activated devices should be considered by distributors. Their benefits in speed, accuracy, reliability and overall cost savings may offset their initial cost and complexity of implementation. It is further suggested that if customers and distributors employ the same technologies, such as batch tracking, bar coding, RFID, and hand held scanning devices, this will provide for faster and more accurate ordering, dispatching from the distributor and receiving at the customer end. Customers already use bar coding more than suppliers so this indicates a big opportunity for distributors. In the implementation of the technologies the project manager must ensure that they are designed for ease of use, as there is a strong correlation between ease of use and accurate outcomes from the technologies. All of the aforementioned technologies do not operate in isolation and will require the implementation of the necessary software systems to support their use. The information systems will be discussed in section 5.4.2, after the transport recommendations.

The warehouse best practices, processes and technologies need to be designed to dovetail to the logistics for transport and physical distribution of the goods to the customers, because the overall efficiency of the warehouse and transport distribution system will impact the total cost of goods delivered to customers. Where these functions are not core to the chemical distributor's business of buying and selling chemical raw materials, and as recommended in the qualitative data, it may be more beneficial to outsource aspects of, or the whole of these functions to third party or fourth party logistics providers (Li, 2007; Rafele, 2004; Bisenieks and

Ozols, 2010; De Villiers, Nieman and Niemann, 2010). For those distributors who choose to continue with their own transport logistics it is recommended that the extra distance tool, evaluating distance and time that should have been incurred as opposed to that actually incurred, as described by De Swardt, Potter, Robinson, and Sanchez-Rodrigues (2011), be employed to identify the complexities introduced into the transport model with the increase of uncertainty due to inaccurate demand forecasts, lack of coordination and information, and delivery constraints, creating inefficiencies in the firm's transport system. The assessments must be used to monitor the demand forecasts, procurement coordination, and customer order management, correct order entry, advanced shipping notification, resource allocation and systems controls for elimination of mistakes. This will facilitate information flows, accurate planning and transport management, improved monthly vehicle utilisation plans for daily deliveries, effective load utilisation, use of transport capacity and maintenance schedules. It will improve turn-around time, earlier, more accurate picking and loading times and improved inbound offloading and outbound loading of trucks at the warehouse. It will further avoid unplanned additional trips to customers and reduce waiting time at customers, effectively reducing additional distance, time, resource utilisation and cost and improving customer service.

It is noted that transport management systems were scored on average 70.24% for effectiveness and reliability in the chemical distribution sector. It is therefore further recommended that the maximisation, monitoring and management of the transport system be facilitated by the use of a full transport management system, integrated with global positioning systems used for vehicle tracking and maps, which facilitates the planning of loads and routes, vehicle and human resource capacity usage, maintenance, reverse logistics and third party logistics. When these systems are further integrated with the warehouse management system and the organisations integrated information system, such as an enterprise resource planning system, it will create a seamless, transparent flow of information and processes, a higher level of automation, speed and accuracy and reduced overall cost of operating.

The logistics functions must be aware of the need for and management of the following:

- a) improvement of logistics efficiency from suppliers and distributors to customers and understanding leverage of logistics for customer service excellence,
- b) implementing procedures to meet the customer needs in line with the chosen supply chain design and categorising customers to prioritise them for service levels,
- c) understanding the company distribution strategy; deliver good service, strive to do better, maintain the vision and make it their mission,
- d) on time, in full and accurate deliveries with short lead times. (Customers rank complete orders higher than distributors, reflecting an area for improvement by distributors),
- e) well maintained, reliable equipment and vehicles with well trained staff who understand the processes to ensure on time, complete and correct orders
- f) vehicles to meet legal specifications for deliveries undertaken, with correct equipment and signage, tail lifts, fire extinguishers, and transport emergency cards,
- g) speed, safety and compliance to standards and procedures. measurement and reporting on these for corrective action,
- h) good pre-planning of trucks routes and loads for faster marshalling and dispatch, and managing of loads for compatibility of products,
- i) ensuring traceability of stock batches to avoid obsolescence due to expiry, ensure compliance with certificates of analysis, proper handling of goods, handling of customer quality complaints and returns, and efficient product recall management,
- j) tracking of physical stock movement to ensure accuracy of stock records, availability of stock and short delivery lead times, and to reduce shrink,
- k) handling of loads and goods in such a manner as to eliminate damage,
- l) efficient, reliable, compliant and cost effective third party logistics providers with service level agreements,
- m) sufficient capacity availability to handle new month orders,
- n) managing the complexity of dealing with smaller customers with small yards and no offloading equipment,

- o) using advanced shipping notices and customer agreements to avoid queuing at customers and to manage customers' service level expectations,
- p) managing customer returns and coordinating with procurement for timing of order collections, to maximise truck capacity and avoid empty return trips,
- q) quick and efficient problem solving for supply, customer delivery or product issues, with inter-departmental team work and clear records of actions taken,
- r) constant information flow and feedback and quick turn-around time with documentation,
- s) constant performance measurement against agreed standards and benchmarks to reduce cost to serve and increase speed, accuracy and outputs, and
- t) use of technology and automation to improve accuracy of picking and despatch, reduce touches, excessive documentation, errors in delivery and records, and duplication of work

The above mentioned recommendations should be used in conjunction with multi-functional team structures and inter-organisation networking and partnerships, to improve the seamless flow of information, processes and goods. They should be underpinned by the organisation structure, technology and management tools and skills development methods discussed further in this and other chapters. It is further recommended that distributors encourage customers to make greater use of demand forecasting to improve the matching of supply and demand, reduce lead time, to improve inventory availability and on time deliveries.

5.4.2 Recommended information system solutions

The applicability of the information system technologies to the chemical distribution sector has been confirmed from the overall rating for effectiveness and reliability of the technologies in the quantitative data and the needs and complexities highlighted in the qualitative data. The most highly rated information systems in the chemical distribution sector to assist with the logistics efficiencies, together with their benefits, are:

1. internet banking – ease of payment of accounts and recording of receipts,

2. basic sales and accounting – simple accounting for accurate sales, inventory, supplier and customer accounts and financial reporting,
3. enterprise resource planning – integrated accounts, procurement, inventory management, sales, demand forecasting, inventory replenishment planning, and customer relationship management. Can be integrated to business to business ordering and online vendor management, as well as production planning, warehouse management and transport management systems,
4. production planning – can be used as a stand-alone system to assist in production and materials requirement planning. (Distributors may use this for repacking and basic blending processes for product sold on to finished goods manufacturers),
5. business to business order processing – this can be operated in-house or in the cloud to supply a direct customer interface for 24 hour access and ease of ordering,
6. online vendor managed inventory – linking distributors to customers' information systems, production or storage systems to monitor inventory levels and automatically generating purchase orders for replenishment of their inventory,
7. warehouse management systems – incorporating from basic batch tracking, bin location, bar code, and labelling, to radio frequency identity (rfid) tagging management, and more complex and capital intensive robotic and automated materials handling systems,
8. transport management – with benefits as defined above,
9. inventory replenishment planning – identifies historical sales volume and demand trends, combined with minimum order quantities and order lead times, supplier grading and costs, demand forecasts and adjustments for seasonality to recommend economic order quantities and order placement dates, and
10. customer relationship management – tracks customer activity on sales and volumes, sales force interaction and activities related to the customer and communication with the customer, as well as management of customer related archived documentation. this can include a customer portal for direct communication, enquiries and complaints or compliment handling.

The use of the technologies and information systems for demand forecasting and procurement is critical to the matching of supply and demand, for effective procurement and advanced shipping notices, to improve planning and resource allocation, to ensure sufficient inventory and on time deliveries, with complete orders. The improvement in procurement, warehouse and logistics efficiencies will facilitate lower total cost of goods to the customer and provide a competitive advantage in the market. Distributors should closely examine the opportunities for implementing information system technologies that can specifically improve logistics but thus far have low implementation rates, such as warehouse management, transport management, inventory replenishment, and online vendor managed inventory, business to business and customer relationship management systems. It is noted that there is an opportunity for distributors to collaborate more closely with their suppliers to improve speed, efficiency and information flows through business to business software and integrated information technology solutions if they improve their adoption rate of these technologies. It is further recommended that distributors engage more directly with customers to assist them in understanding the benefits of the best practices and technologies mentioned above, and to encourage them to increase their adoption rates of these, even if done via a networked relationship that ties them more closely to the distributor, supplying the distributor with a competitive advantage. If cost of the technologies or information systems is considered a constraint the customer, distributor or supplier should consider using hosted services available through 'cloud' computing.

Further recommendations are given from the qualitative data for the employment of effective telecommunication systems and technologies, such as Skype, email and fax. Although low technology they are vital for good communication and information flow and can interface with the ERP, supplying records of communication with business partners. Finally, it is recommended that the sector invest in training and acquiring the necessary skills relating to the use of the technologies and information systems in order to ensure their successful implementation and the maximisation of the benefits of their use. It is asserted that even where these technologies are already employed the employees and managers require up-skilling to realise the full potential of the investment that has

been made and improve the organisation's ultimate efficiency and competitive advantage.

5.4.3 Human resource recommendations

From the qualitative data and the literature reviewed it is noted that the aforementioned best practices and technologies are rendered ineffective by poorly trained, low skilled or poor performing managers and employees. Distributors rated both the impact of individual employees on logistics efficiency and the impact of training on an employee's ability to perform at 91.43%. Peko and Ahmed's (2011) concept of, "a strategic approach that affords the opportunity to differentiate a commodity product to become a market leader by developing a core competence in logistics for competitive advantage" is very relevant to the chemical distribution sector in South Africa. It is noted that the statistical analysis revealed poor availability of skilled workers for warehouse and transport operations and for administration functions in the sector. Logistics efficiency improvement will therefore require an analysis of the required skillset, with a focused plan to close the gap between required and available skills. In order to understand what the required skillset will be the distributor will need to:

1. Identify what the business vision and strategy and desired supply chain design is.
2. From this outline identify what core capabilities the firm will require to achieve its objectives.
3. From these the required core competencies can be identified.
4. This will then define what skillsets are required.

The identified core capabilities required for logistics efficiency that distributors need to develop are:

- a. effective international and local supply chain management,
- b. effective inward logistics and supply lead time management for accurate availability forecasting and commitments to customers,
- c. the ability to develop relationships, explore opportunities and implement them for the benefit of customers and the organisation,

- d. efficient order taking, processing, document handling, information, process and goods flow for quick turnaround time with on-time and in full deliveries without errors,
- e. ability to move inward and outward flows of high volumes of products in varying sizes of order quantity,
- f. efficient transport management and fleet capacity utilisation, and
- g. product knowledge and understanding of their uses,

It is recommended that firms need to assess and reengineer their core processes and capabilities to link their activities into the greater structure of networked business value chains because customer retention through excellent, responsive service is essential (Hayes, 2004; Rainbird, 2004). Suppliers and distributors must work closely together to improve product knowledge and customer service delivery (Baker's, 2011). This is reinforced by the recommended skillsets for the sector.

The identified required skillsets recommended for the sector are:

- a) knowledge of the chemical industry, products, customers and their needs,
- b) knowledge of relevant legislation, hazardous goods and safety,
- c) procurement and negotiation,
- d) supply chain management, planning and communication skills,
- e) proficiency in logistics, shipping, distribution and transport scheduling,
- f) modern automated warehousing, stock, storage, and stacking management,
- g) qualified truck drivers and assistants, and forklift drivers for hazardous goods handling, stacking, storing and delivery,
- h) understanding of cost drivers and management and tracking thereof,
- i) systems and process management as well as the implementation and use of ISO quality systems and other similar management tools, and
- j) basic literacy and computer skills.

Halley and Guilhon (1997, p.491) asserted that "Strategy preparation lies first and foremost in human resources management based on the development of general logistics competencies and core competencies". It is therefore recommended that distributors need effective human resources management, recruitment, training

and skills development, talent management and retention strategies, to keep and attract the top talent and set the firm apart from its competition (Hofmann and Frankemolle, 2006; Halley and Guilhon, 1997; Valk, 2011). A change in leadership style may be required to sustain improved operational performance, with:

- a) regular performance management,
- b) clearly stated key performance indicators that are measured and communicated down to the shop floor,
- c) hands on involvement by management in change management to realise sustained changed behaviour,
- d) ensuring effective delegation of tasks and responsibilities,
- e) identification and trouble shooting of problem areas in cross functional teams, and
- f) encouraging employees to ask for help and further training in order to meet the operational objectives.

(Porter, 1985; Halley and Guilhon, 1997; Birnbaum, 2006).

Gattorna's (2010b, p.131) "capability levers" below should be considered by distributors for shaping organisations for effective logistics operations:

- a) "organisational structure,
- b) reporting lines and decision making powers,
- c) people positioned effectively in the organisation's structures according to their natural strengths,
- d) job designs,
- e) identified key performance areas and performance measurements with matching incentive schemes and motivation,
- f) development and training programs,
- g) recruitment from external sources with both the required technical skills and appropriate mind-set to support planned initiatives, and
- h) role modelling and leadership style of top management team".

In line with this, the specific recommended HR strategies identified from the qualitative data for the South African chemical distribution sector include:

- a) management with good organisational skills, good downward and upward communication and feedback,

- b) the HR function seated at top management level interpreting areas requiring strengthening, understanding reasons for poor company performance, poor customer satisfaction, buying and stock control issues and assisting in making necessary adjustments; influencing company policy for implementation of recruitment and training programs,
- c) proper screening and literacy testing at the recruitment stage and employment of team players with the correct attitude, experience and qualifications for the level of employment and tasks to be completed,
- d) use of salary surveys, fair remuneration and packages that lure good talent and suitably skilled people,
- e) employ staff with ability to speak a number of the 11 official languages in South Africa to improve third party communication,
- f) use of induction programs, standard operating procedures and processes, so that employees know what is expected of them; non-conformance reports to ensure corrective action, counselling and discipline procedures to adjust poor performance,
- g) Employees clear on the company structure, the organogram and reporting lines,
- h) Skills gap analysis for existing to desired skills, development plan to close the gap, key performance indicators, effective employee review and performance management programs, performance evaluation and good rewards system,
- i) Identify key employees and skillsets and ensure good quality, on-going training and continuous development, on the job training and outside training programs of which employees are aware,
- j) Develop staff to deal effectively with customers, truthfully, intelligently, respectfully to ensure effective customer liaison and customer satisfaction while guarding the distributor's image and reputation,
- k) Encourage a learning and knowledge development culture in the organisation, and
- l) Use of employee surveys to understand where satisfaction and dissatisfaction reside in the organisation to improve company and HR strategies for the ultimate improvement of the company and its competitive advantage.

Considering point (g) in Gattorna's (2010b) capability levers, the fact that there is a lack of skills and the sector having a low rate of employing for talent, it is asserted that skills in supply chain management, procurement and logistics can be transferred from other industry sectors. Therefore distributors should consider employing talent from other sectors if they cannot find the talent directly in their sector.

From the above, the need for training and skills development is evident. In order to continuously develop and improve logistics efficiencies for competitive advantage sustainable continuous improvement is required. Structured and planned training programs which are tailored to the needs of the organisation, with the emphasis on spreading skills and knowledge and building functional and area experts to improve core competencies and competitive edge are required (Nickel, 2006). In this light the following identified skills development methods are recommended:

1. on-the-job training – less formal one-on-one training by colleagues and supervisors to complete particular tasks,
2. internal training facilities – physical resources on site with in house or outsourced trainers providing training,
3. job specific training – more formal on or off site training aimed at developing employees in specific areas of their jobs,
4. diplomas or degrees – tertiary education done full time or part time through a recognised teaching institution,
5. coaching – the employee takes ownership of the learning process and the coach, qualified in the area of work, acts as a learning facilitator,
6. formal training programs – structured course material applied over long or short term courses, on the job or off the job to give outcomes that meet the company's skills development needs,
7. mentoring – a peer or indirect supervisor assigned to a new employee to assist in their induction acculturation, and company specific training, or a manager mentoring a candidate manager to smooth their growth,
8. job rotation – moving employees to different jobs within or between departments to improve multi-skilling and skills transfer,

9. short courses – one day to six month courses, including topic seminars, on site or offsite for continued professional development or up-skilling of employees and managers,
10. external training facilities – at teaching institutions with independent courses or outsourced with company specific training courses,
11. learnerships – a structured, vocation specific learning program with learning modules, linked to the south african qualifications authority framework, designed for development of low skilled employees which combines on-the-job and book learning and assignments,
12. study loans - designed to facilitate employees improving their level of education, even if the course is not directly related to their job,
13. bursaries – the company paying for employer selected formal training and tertiary education to improve the company's skills base,
14. career path training – specific courses and education, coaching and mentoring designed to prepare an employee for the effective fulfilment of a role for which they have displayed potential and for which they have been earmarked for promotion, and
15. adult basic education – on or off site, in house or independent teaching designed to assist employees acquire basic literacy and numeracy, or to take them to a matric equivalency

The above skills development methods can be used individually or interchangeably to support the company's objectives and skills requirements. They are stated in the order of their rating for effectiveness in the quantitative data analysis and it is noted that for the last five named methods there is a 91% correlation between rate of implementation and rating for effectiveness. It is asserted that this is not a reflection on their effectiveness but rather on their lack of application. Distributors should still strongly consider them for closing the skills gap and ensuring effective employees and managers. Specific mention is needed for job rotation, as this is noted in the Barloworld (2011) survey as a popular method of skills development and is inexpensive, yet it has a low rate of adoption in the sector.

Considering the noted skill sets required for the sector, distributors need to do more to assist their identified employees in gaining access to tertiary education where necessary to acquire these skills. In addition it is noted that a number of management skills are identified as requirements. The use of career path training with tertiary education will be of significant benefit here. Distributors should take advantage of government basic education, and further education and training initiatives. Furthermore, investigate methods of developing core skills and capabilities with alliances and joint ventures and internal learning programs, using external expertise from suppliers, consultants and customers as a further source of 'functional knowledge and experience' for success in chemical distribution operations (de Mahieu, Günther, and Riese, 2006). Collaborate with other firms, government and educational institutions for skills transference and "work-integrated learning", with a combination of tertiary education course work and structured learning at work, to improve the work place skills of employees, and assist the country and sector in resolving the issue of scarce skills, as recommended by the department of labour scarce skills report (Kilbourn and Wessels, 2011).

5.5 Limitations of this study

The main limitation to the study was the time factor, as the short time frame limited the number of responses the researcher was able to secure from the target population. Given more time the researcher would also be able to conduct a number of face to face interviews and on-site research visits that could add value to the study.

The second limitation to the study was the method of dissemination used for the questionnaire. With the number of undelivered emails due to mail format and spam filters, discontinued or incorrect email addresses, the original target population was greatly reduced, limiting the final number of responses received.

The third limitation was that some of the elements in the target population decided not to complete the questionnaire due to their fear of disclosing proprietary information or impacting on their own organisations' competitive advantage. This

reservation was made more significant by the fact that the researcher is employed by one of the distributors.

The fourth limitation was the scope and length of the dissertation. Each of the aspects of the study, best practice, warehouse processes and procedures, transport, logistics and distribution, information technology and human resources management can in itself constitute a full study in context of the chemical distribution sector. Due to the limitations of the length of the study the required brevity on each of these sections has limited the amount of questions that could be asked and data that could be collected and analysed on each. More time and space would allow for a much more thorough study.

The final limitation relates to the lack of literature available on the chemical raw material distribution sector, especially in South Africa. The majority of available literature related to the chemical industry in Canada, America and Europe, with some pieces relating to China, the East and Australasia. The studies found in South Africa related to the logistics sector did not relate specifically to the chemical industry.

5.6 Recommendations for further studies

Looking at the results of the data collected on the rating for effectiveness of the management tools in Q16.3, further study would be required to understand the full reason that distributors rated bench marking, performance measurement, advanced shipping notices, lean methodology, continuous improvement, customer satisfaction surveys, time compression, standardisation and six sigma as less effective than customers and suppliers did. Is this a symptom of the tensions between satisfying the needs of suppliers to whom they add value and offer a service on one hand, and to the customers to whom they sell the products and attempt to add value and give a service on the other hand? Further investigation would also be required to understand why performance measurement, demand forecasting and customer satisfaction surveys are the most implemented and properly run, yet rated lower for effectiveness.

Considering the low implementation rate and low rating for effectiveness, further study would be required to understand the true applicability and effectiveness of Six Sigma in the chemical raw material distribution sector. How easily can its analytical, measurement, and standard deviation concepts and continuous improvement tools be applied in the sector?

There was incongruence with the high acceptance rate that technology can improve logistics efficiency and the low adoption rate of technology in the sector. Further study would give better understanding of the reason for the low adoption rate of the technologies and information systems in the sector, and in particular in the customer and distributor categories. Further investigation would be needed to establish whether the sector would require a higher level of cost savings to regard implementation as worthwhile, or whether the low adoption rates relate to affordability.

The challenges faced by distributors relating to the complexities in importing, such as port congestion, exchange rate volatility, long lead times, shipping and logistics for imported product, import communication, time zone differences, documentation and controls, inter alia, was too vast an area to investigate in the scope of this study. Understanding how to overcome these complexities would be useful to the South African chemical distribution sector.

Due to the constraints of the length of this study it was not possible to dig deeper into the solutions to delivery issues such as the break bulk nature of supplying smaller customers, coping with the majority of orders being placed for delivery in the first week of the month causing capacity bottlenecks, offloading at smaller customers with limited space and without equipment, and moving the right volumes of low cost products without damage to ensure customer service and profit. This too would be a useful study for the sector.

5.7 Conclusion

The title of this study is logistics efficiency in the South African chemical distribution sector. The aim of the study was to research and investigate available best practices, technologies and human resource strategies to improve logistics

efficiencies for optimal customer service in the chosen sector. Some best practices were identified from the literature reviewed and tested for applicability in the South African sector. This body of knowledge was added to by further practices identified in the qualitative research. The relevant best practices were recommended in this chapter. It was noted from the literature reviewed, and confirmed by the research findings that the rate of adoption of technologies for improved logistics efficiencies in the chemical raw material distribution sector is low. The applicability of the identified technologies and information systems was tested in this study and from the findings the relevant recommendations for adoption of technology for efficiency improvements have been made. A number of core capabilities, competencies and skill sets, as well as a number of human resource strategies were identified in the study. These were combined with relevant information, and the skills development methods identified in the literature and reviewed and tested in this study for applicability to derive recommendations for use of these for logistics efficiency improvements in the South African chemical distribution sector. Although there were some limitations to the study and recommendations for further studies have been noted, this study has explored and answered the objectives. It will assist the chemical raw material distributors to run efficient logistic operations and optimise their customer service excellence for a competitive edge and improved profits.

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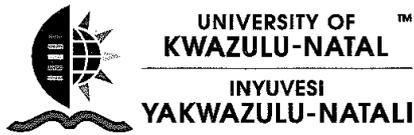
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APPENDIX - Ethical Clearance Certificate



7 August 2012

Ms Karen Valery Bayley 210512548
Graduate School of Business and Leadership

Dear Ms Bayley

Protocol reference number: HSS/0678/012M
Project title: Logistics Efficiency in the South African Chemical Distribution Sector.

EXPEDITED APPROVAL

I wish to inform you that your application has been granted Full Approval through an expedited review process.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number. PLEASE NOTE: Research data should be securely stored in the school/department for a period of 5 years.

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

Yours faithfully

.....
Professor Steven Collings (Chair)

/pm

cc Supervisor: Mr Danny Mc Cabe
cc Academic leader: Dr S Bodhanya
cc School Admin: Mrs Wendy Clarke

Professor S Collings (Chair)
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