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CENTRAL SUPPLY CHAIN DISTRIBUTION SYSTEM DIFFUSION IN THE SELECTED RETAIL GROCERY INDUSTRY

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ABSTRACT

Purpose: *The purpose of this study to explores the adoption of the central supply chain distribution (CscD) system in relation to the degree of product availability and consolidated retail order replenishment frequencies in stores for end-consumer satisfaction. This study manifests a purpose to understand the intercorrelated dimensions and relationships between these dimensions and CscD system diffusion.*

Design/methodology/approach: *The measuring instrument for primary data collection (questionnaire) from the target population (managers and supervisors in fast moving consumer goods (FMCG) retail stores) was used with descriptive statistics, factor analysis (intercorrelation) and multiple regression analysis (relationship) as major research methods for exploring the CscD system diffusion.*

Findings: *The study findings revealed that the CscD system makes quasi-real-time products availability in the supply chain network using integrated information sharing and technology systems to improve business efficiency. It is also noted that the agile CscD system with advanced supply chain technology needs to be supported by a fully integrated information system that provides visibility of the whole supply chain for fast replenishment of goods in stores customised precisely to the needs of individual retail stores.*

Practical implications: *The managerial implications in the FMCG retail outlets would mean that the central distribution centres with underpinning supply chain technologies have the potential to enhance financial rewards for the retail stores and reduce the price that customers ultimately pay for goods from consolidation of inventory, frequent delivery loads and sales volume maximisation.*

Originality/value: *The paper is the first value-added and formal empirical research attempt to model the factorial dimensions in the phenomenon of CscD system. The paper puts forward the perspective of CscD system diffusion in the major selected retail grocery stores as the South African FMCG retail stores expand their business operations to the African continent. The paper also contributes to the existing literature on decentralised and centralised systems in the FMCG industry.*

Keywords: *Retail distribution centre, Supply chain technology and sharing, Product availability, Service chain management and Customer service.*

1. Introduction

The CscD system diffusion transcends the traditional silo-orientation and legal contractual boundaries of entities along the supply chain and instead views the entire chain as a single entity. The centralised supply chain distribution centre (CscDC) or warehouse in this context is the facility in the supply chain network that receives goods from the upstream side, stores them in the centre, and ships them to the downstream individual retail stores. Although the terms "distribution centre" and "warehouse" are used interchangeably, the Council of Supply Chain Management Professionals (CSCMP) (2005:36) defines a distribution centre as a warehouse facility that holds inventory from manufacturers, pending distribution to the appropriate stores. De Villiers, Nieman and Nieman (2008) describe a warehouse as a place where raw materials, work-in-process goods or finished goods are stored. Schroeder (2008) and Cachon and Terwiesch (2009) note that centralised supply chain decision-making requires reciprocal interdependence between echelon stream sites to ensures that the right products and quantities are delivered to the individual retail store from

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the retailer's distribution centre. Wigand (2003) defines diffusion as the social process by which an innovation is communicated through certain channels over time among members of a social system. This interpretation dovetails with elocution by Simchi-Levi, Kaminsky and Simchi-Levi (2008:1) elliptical definition of supply chain management as "a set of approaches utilised to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the locations, and at the right time, in order to minimise systemwide costs while satisfying service level requirements". This study models construe supply chain as a network that captures the relationship between costs, like inventory and distribution and the time domain characteristics of customer service, in terms of responsiveness, agility, efficiency and reliability in customer delivery.

The CscD system recognises the customer-supplier duality where suppliers deal with a retailer's central distribution centre in an inherently bidirectional way, with few echelon-levels of interaction (Fitzsimmons and Fitzsimmons, 2006:478). Notably, information technology is the driving force behind the CscD system's ability to coordinate the many interrelated activities commonly performed by upstream independent companies. This archetype of the supply chain under central distribution will enable managers to evaluate which options between centralised and decentralised approaches will provide the greatest improvement in customer satisfaction at reasonable cost.

Problem statement: The central supply chain distribution (CscD) system brings simplicity to inbound (suppliers) and outbound product flow (retail outlets) distribution, and enables an integrated supply chain to deliver and sustain the cost-effective availability of a wide product range in different stores across broad geographic locations. The distribution centres owned by retail outlets seem to epitomise certain benefits in terms of economies of scale, higher order quantity discounts on purchase volume, and other benefits such as higher service levels, electronic information sharing and shelf-availability.

The main objectives of this study contemplate:

- To explore the adoption of the CscD system in relation to the degree of product availability and consolidated retail order replenishment in stores for end-consumer satisfaction.
- To examine intercorrelated dimensions in CscD system diffusion as consolidation in the consumer demand data sharing.
- To understand the relationship between the effect of CscD system adoption and the magnitude of consolidated product delivery for elongated availability to integrated electronic supply chain management systems.

The selected research methods will attempt to address these research objectives from the empirical perspective. This study focuses on CscD approach for the purpose of understanding the pattern of reliable delivery (daily deliveries from the central warehouse) to explore whether the products can be visibly available on the shelves when consumers make their decisions about what to put in their baskets. This study intends to understand the simplicity to inbound (suppliers) and outbound (retail outlets) distribution, and enables an integrated supply chain to deliver and sustain the cost-effective availability of a wide product range in different stores across broad geographic locations.

2. The nature of the fast moving consumer goods (FMCG) industry

The fast moving retail outlet is a self-service store, offering a wide variety of food and household merchandise, organised into departments. It is usually situated near a residential area, in a shopping mall or in the city centre in order to be convenient to resident and working consumers. Its basic appeal is the availability of a broad selection of goods under a single roof, at relatively low prices. Consumers normally spend a limited period of time at the retail outlet and purchasing decisions tend to be made when customers look at the shelves. Although the diverse geographic locations these retail stores are supplied by the central, through the regional distribution centre of their parent companies, which operates numerous retail stores across South Africa and the African continent, the consumers expected elongated on-shelf availability of goods at lower prices.

It is understood that the CscD system assists the retail stores to make up for the lower margins through a higher volume throughput, higher overall volume of sales, the sale of higher-margin items, giving each product section a sense of individual

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difference and altering customer's perceptions of the atmosphere (Gajanayake, Gajanayake and Surangi, 2011 and Browne, 2010). These retail stores are known as fast moving consumer goods (FMCG) or consumer packaged goods (CPG) outlets. The retail goods are generally replaced or fully used up over a short period of time, be this days, weeks, a month and within one year. Although the absolute profit made on FMCG products is relatively small, they generally sell in large quantities, so the cumulative profit on such products can be large.

3. The South African fast moving consumer goods industry

The South African FMCG industry is dominated by six major chains: Shoprite/Checkers, Pick 'n Pay, Woolworths, SPAR, Massmart and Metro Cash and Carry (Metcash), with the last two performing both retail and wholesale functions (FASWorldwide Report, 2007). These major retail chains have developed highly centralised procurement systems, with distribution centres located in the major metropolitan areas throughout South Africa.

SPAR has improved its warehouse management systems and adherence to best operating practices using on-time deliveries by suppliers to SPAR distribution centres. According to the Psion Teklogix Report (2009) the SPAR central distribution centres distribute consumer goods to individual retailers around South Africa, resulting in improved productivity levels and worker morale, better quality, improvements in the accuracy of distribution centre systems, reduced costs through higher volume procurement discounts and a substantial improvement in the firm's relationships with retailers.

The Shoprite Group uses the central distribution strategy to measure its success by range, availability and price, and to enhance quality, consistency and the overall shopping experience. The Industrial Logistics Systems Report (2010) confirms that the central supply chain distribution system allows Shoprite to access significant benefits and savings through improved on-shelf availability, and the flexibility to deliver to stores when goods are required and not be dictated to by supplier delivery schedules. This means that deliveries will not be dependent on supplier reliability, which reduces the potential for stock outs and costs, and consequent lost sales.

Woolworths' stores receive their fresh produced products through a central procurement system. The Woolworths distribution centres consolidate distribution to individual retail outlets and have sufficient capacity to serve an aggressive store rollout policy, where each store receives new deliveries every day. The CscD system has reduced turnaround time and bulk deliveries are broken up to build specific store orders (Woolworths Report, 2007).

Pick 'n Pay recently came to the realisation that its current distribution operations are running over capacity and have become inefficient, resulting in stores being overstocked and a deterioration in customer service levels. According to the Whichfranchise Report (2010) the significant benefits of a CscD system include the improved availability of stock (product availability), lower prices and a streamlined ordering process, with staff in the individual retail outlets concentrating on shopper engagement.

Firms have begun to consolidate their distribution activities in few centres as transportation services become fast, flexible and efficient due to government's infrastructure development programme. Every FMCG retail store is striving for market share and to become a competitively superior supermarket by adopting an efficient CscD system. The reduction of operational costs and assurance of daily deliveries from the central warehouse have been epitomised by huge investment on physical and technological capacity development.

The capacitated central warehousing practice focuses on directly involving suppliers to realise high levels of product availability, service levels and stock runs to underpin the systems of cross-docking and flow-through. The Industrial Logistics Systems Report (2010:3) defines cross-docking as moving pre-picked products through a distribution centre directly from receiving to dispatch, while flow-through occurs when a product is "flow picked to zero" directly on receipt without storage. These systems deal with the receipt of finished goods from various upstream manufacturers, put them together into a package in the midstream, and send them on to a downstream retailer who is the customer.

4. The processes of Distribution Centres

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Certain retail stores own their outbound warehouses and fast moving distribution centres to achieve economies of scale through quantity purchasing discounts and forward buys from suppliers. This will result in selling prices to the end-consumer being reduced. Arguably, a distribution centre is the antithesis of a warehouse; the centre forms the nexus between retailers and their suppliers to ensure incoming deliveries match purchase orders, and routes orders for shipment to the correct store. De Villiers *et al.*, (2008:57) note that the fast moving distribution centres underpin the store's customer service policies by prioritising items like A and B items in the ABC analysis. Heizer and Render (2011:658) maintain that the just-in-time programmes of suppliers, vendors and customers ultimately overcome the time and space differentials that exist between the upstream products and downstream customers. These programmes result in the least total cost logistics, corresponding with a desired level of customer service.

In the streamlined and consistently evolving distribution process, Coyle, Bardi and Langley Jr (2003) note that the system of national, regional and zone distribution centres, and local branches support new opportunities and demands. The system allows for improved customer service, contingency protection (delays and vendor stockouts) and smooth operations in the manufacturing process either on supplier or on retail distribution centres.

5. Retail Distribution Centres

In South Africa, the current trend is towards purchasing supply chain centralisation for the fast moving retail stores. The distribution centres owned by retail chains can take advantage of economies of scale and other benefits such as higher order quantity discounts on purchase volume, sound policy decisions and better-negotiated controls. The centre uses sales and inventory information to trigger replenishment orders from upstream suppliers/manufacturers by generating volume purchase orders compounded by quantity discounts (Kachru, 2009). The system benefits through break-bulk operation at district level. While the business buys and receives a single large shipment from different suppliers, the system synchronises the arrangements for full-truckload local delivery to multiple retail outlets (Bowersox, Closs and Cooper, 2010:247). West (2003:230) refers to inventory as "the stock of products held to meet future demand", while inventory management is defined by Desselle and Zgarrick (2005:382) as "the practice of planning, organising and controlling inventory, which is the main contributor to the profitability of the business". The CscD model allows for an integrated service that consolidates products for delivery and expedites the services of premium transport, combined with supply chain information technology. The practice of passive warehousing storage has shifted to a strategic assortment of supply chain distribution centres to offer upstream manufacturers a way of reducing the holding or dwell time of materials and parts that would eventually become integral to just-in-time (JIT) and stockless production strategies.

Mutlu and Cetinkaya (2011:360) note that the centralised approach is more efficient for the supply chain as a whole, although different members of the chain are seldom controlled by a central decision maker and individual objectives often conflict. Collins, Henchion and O'Reilly (1999:105) describe the consolidation centres owned by large retailer as retail distribution centres (RDCs) that specialise in combining or consolidating inventory from multiple origins into an assortment for specific retail outlets or customers. These retail centres are underpinned by cross-docking and mixed consolidating methods to reduce overall product storage in the supply chain, achieve customer-specific assortment and minimise transportation costs (Bowersox *at al.*, 2010). Hugo, Badehorst-Weiss and van Biljon (2006:285) enumerate the advantages of CSCD centres: firstly, they promote efficiency through the principle of postponement; secondly, they facilitate economies of scope, ensuring that full load-deliveries are made to retail depots; and lastly, they promote greater supply chain visibility as participating retailers can view stock in the system through the use of common information systems.

These stores tend to have lower inventory levels, increased frequency of deliveries to enhance product availability, greater product variety, improved product alignment with customer demand from mitigated order variability, and shorter time in stock (Hugo *et al.* 2006 and Collins *et al.* 1999). This flow-through distribution system allows active storage that includes the assembly of goods from various upstream suppliers, the combination of goods and the shipping of the combined orders to customers. According to Bartholdi and Gue (2004:235-244) cross-docking favours the timely distribution of freight and better synchronisation with demand, with the distribution centre essentially acting as a high throughput sorting facility. The distribution centre is just one link in a sequence; being efficiently connected to the upstream segment can be as important as being connected downstream in order to ameliorate the oscillation of the bullwhip effect.

6. Supply Chain Information Technology and Sharing

Suppliers, distribution centres and retail outlets should be embedded in a web of reciprocal transactions where supply chain technologies (radio frequency identification (RFID), EDI and SAP) link with the physical and information flows to adapt quickly to changes in demand. The CscD system combines information, communication, cooperation, and physical distribution through supply chain technologies. According to Nahmias (2009:348) Electronic Data Interchange refers to the electronic transmission of standard business documents in a predetermined format from one company's business computer to its trading supply chain partner's computer to create an industry wide system. Pok (2008:2) recommends improved technologies such as RFID. The use of RFID in the retail environment leads to reductions in inventory levels and enables better collaboration in the supply chain (Wamba, Lefebvre, Bendavid and Lefebvre (2008:620), although Schuster, Allen and Brock (2007: 135) argue that the use of RFID at the retail level is solely to prevent theft. Providing a broader perspective, Li, Yang, Sun and Sohal (2009:128) state that this technology has the ability to provide timely, accurate and reliable information in which the costs of transacting will be reduced amongst the trading supply chain partners.

Bottani and Volpi (2006:230) assess the impact of RFID technology implementation using the grounded method on the Supply Chain Operation Reference (SCOR) model as a conceptual framework for the analysis of distribution centres of the FMCG supply chain. The authors describe the SCOR model as a process reference model that provides standard guidelines for companies with the aim of examining their supply chain configuration and, identifying and measuring matrices from the conjoint of four processes (Plan, Source, Make and Deliver). The introduction of RFID into the distribution process presents specific benefits that include the availability of real-time information, an increase in inventory visibility, stock-out reduction, real-time access and updating of current store inventory levels, the availability of accurate points of sales data and better control of the whole supply chain (Bushnell, 2000; Prater, Frazier and Reyes, 2005; Thiesse and Fleisch, 2008 and Li *et al.*, 2009).

Slack, Chambers and Johnston (2007:426) stress the importance of supply chain technology systems like electronic point-of-sale (EPOS) to consolidate and transmit aggregated sales data and necessary information from the individual retail stores to the centralised supply chain distribution centre. In turn, this centralised system facilitates the sharing of information among the supply chain trading partners through electronic data interchange (EDI) to activate the agility of the whole supply chain system. Lawrence, Jennings and Reynolds (2003) refer to the supply chain distribution centres as the midstream site of the supply chain. These centrally positioned centres are expected to be more of an information-based, as opposed to inventory-based, hub in the supply chain network.

The expectation that the supply chain distribution centres will gather information means that the centre will be required to obtain a greater volume and / or quality of information from the end-user. According to Monczka, Handfield, Giunipero, Patterson and Waters (2009:92) the centralised purchasing system helps to consolidate purchases from different individual retail stores into larger orders with quantity discounts. This allows for the negotiation of more favourable terms with the best supplier to reduce end-consumer prices. The distribution centre replenishment collaboration strategy includes all storage points in the supply chain, from retail shelves to improved product availability and positioning inventory. While the supply management site in the raw material warehouses build anticipated orders into future production plans and improve replenishment accuracy (Colleen and Palmatier, 2004; Chopra and Meindl, 2007; and Bowersox *et al.*, 2010). Nahmias (2009) stresses that the central distribution centre inventory allows risk pooling among the stores and facilitates redistribution of store inventories that might grow out of balance. In underpinning the consolidated pool, Cachon and Terwiesch (2009:338) indicate that the distribution centre provides the retailer with a centralised location for inventory while still allowing them to position inventory close to the customer.

7. Consolidation Strategies

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Wanke and Saliby (2009:678) support the previous authors (Nahmias, 2009, and Cachon and Terwiesch, 2009) on consolidation efforts that inventory centralisation, order splitting and transshipment are the cornerstone tools to measure inventory costs, service levels and total costs. Inventory centralisation physically consolidates stock at a limited number of locations (often a single facility) from which all demand is satisfied (this results in demand pooling), although distribution costs are higher when compared to decentralised systems (Wanke, 2009:107-124). The underlying idea is that inventory increases as the standard deviation of either demand or lead-time increases, and, as a result, companies may attempt to reduce inherent variation by pooling it. Evers (1999:121-139) describes order splitting as a stock keeping location that operates independently of all facilities in filling its demand, but divides its reorders (not necessarily evenly) among multiple suppliers. Thomas and Tyworth (2006:245-257) are of the view that there is a lack of attention to transport economies of scale, as well as to the safety stock benefits from a total system cost perspective, despite the worthwhile pooling of lead time risk by simultaneously splitting orders. Transshipment occurs when a facility satisfies every demand coming from another territory. It implies that a given proportion of demand is supplied from facilities located in different markets, regardless of whether there is sufficient inventory in the original serving facility (Wanke and Saliby, 2009:679).

In terms of consolidation, transshipment facilitates the shipment of goods to an intermediate destination, and from there, to yet another destination. Rojas (2007:8) reports that the system combines small shipments into a large shipment, dividing the large shipment at the other end through either transloading (from ship to road transport) or transport hubs. In the CscD system, the distribution centre serves all customers, which leads to a reduction in variability measured by either the standard deviation or the coefficient of variation (Cachon and Terwiesch, 2009 and Wanke, 2009). The higher the coefficient of variation, the greater the benefit obtained from centralised systems, that is, the greater the benefit of risk pooling. The central repository synergy synchronises the individual retail outlets' changes on planograms, and emergency and planned promotions while allowing for a continuous flow of information and customer behaviour with no artificial barriers to impede the reaction time (Vendrig, 2008).

8. Product Availability

A firm's ability to establish and maintain satisfactory customer relationships requires an understanding of buying behaviour, that is the decision processes and acts of people involved in buying and using products. According to Pride and Ferrell (2009:171) consumer buying behaviour refers to "the buying behaviour of ultimate consumers, those who purchase products for personal or household use and not for business purposes". The CscD system allows most consumers to spend little time or effort selecting products from the shelves. The system enhances the decisions and activities that make products available to customers when or where they want to purchase them. Consequently, a customer practices routinised response behaviour when buying frequently purchased low-cost items, requiring very little search and decision effort (Pride and Ferrell, 2009:172). South African retail stores have an intensity of market coverage, with stores located nearby, and the minimum time is needed to search for a product at the store. This implies that sales may have a direct relationship to product availability. In such cases, physical supply chain distribution costs may be a minor consideration when compared with product availability, degree of service excellence, dependability and timeliness. Although the appropriate degree of availability varies with the characteristics of the product and the target customers, Mullins and Walker (2010:313) suggest that the market and competitive factors in the FMCG influence a firm's ability to achieve a desired level of product availability through effective use of e-SCM systems and functional CscD systems to enhance customer service.

9. Service Chain management

Service excellence is a critical success factor amongst the trading supply chain partners. The service-dominant logic that indicates a collaborative value-creation business alliance to achieve a certain unified business goal is formulated through an interdisciplinary study known as Service Science (Lusch, Vargo and Wessels, 2008; Larson, 2008). A business alliance as service chain management (SvcCM) which enables service and/or product organisations to improve customer satisfaction and reduce operational costs through intelligent and optimised forecasting, planning and scheduling of the service

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chain (Jung, 2011:2206). The fast moving consumer goods retail stores attempt to address service chain activities through CscD systems by synchronising activities to release their workforce for consumer-oriented activities. The service chain is configured for a better understanding of service chain management from the perspective of the value network composed of consumers, logistics service providers, multi-tiers of suppliers and auxiliary enablers of technologies and systems (Basole and Rouse, 2008:53-70).

The semantic approach to business alliances, value networks and service chains is to automate interoperability processes between heterogeneous businesses for ontology-based supply chain management, which entrenches electronic systems for information sharing (Jung, 2011:2207). In the FMCG industry, the retailer's customer service efforts enhance and increase customer attraction, retention and reputation from CscD sytems. These dimensions of retail store customer service are described by Wiles (2007:23) as provision of information (knowledgeable retail staff answering questions and furnishing product information and usage), provision of solutions (thoughtful and customised information and recommendations), passionate dedication to customers, warm and approachable, friendly customer service, emphatic understanding of customer needs, and shopping ease with a convenient shopping experience. The service chain management should provide complete service package with distinct customer service level satisfaction.

Customer service should create positive customer cognition and behaviour that generates financial benefits for the firm. Although Anderson and Mittal (2000:107-120) describe the relationship between service and satisfaction as non-linear, in the sense that service leads to increased customer satisfaction while satisfaction leads to increased retention (Zeithaml, 2000). The customer service efforts have been found to increase customer satisfaction, leading to increased repurchase intentions, willingness to recommend, and share-of-wallet (Sirdeshmukh, Singh and Sabol, 2002: 15-37). The Service-Profit chain (Wiles, 2007: 20) is presented in the diagram below. The diagram shows that customer service creates financial benefits for the firm in terms of revenue, cash flow and profitability. Wiles' research further indicates that the firms can be confident that their investments in customer service are justified as one of the best routes for raising shareholder value. If the CscD system facilitates the product availability by positioning inventory closer to the customers, the individual retail outlets can improve customer service.

10. Customer Service

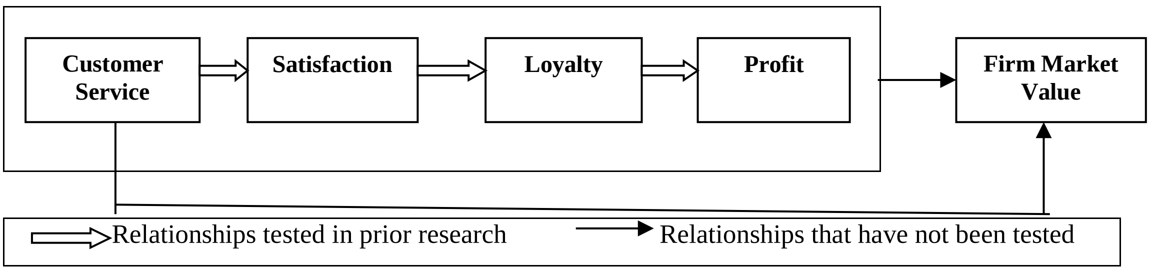

Figure 1: The relationship between service, profit and firm market value

Source: *Wiles, M.A. (2007) "The effect of customer service on retailers' shareholder wealth: The role of availability and reputation cues". Journal of Retailing, 83(1) 19-31*

The service package can be delivered by relieving retail store staff of order replenishment and the manual updating of inventory by shifting to electronic and CscD systems. The centralised distribution centre, underpinned by a regional distribution centre network, and cross-dock network, positions the product closer to customers to enable shorter order lead times with quick

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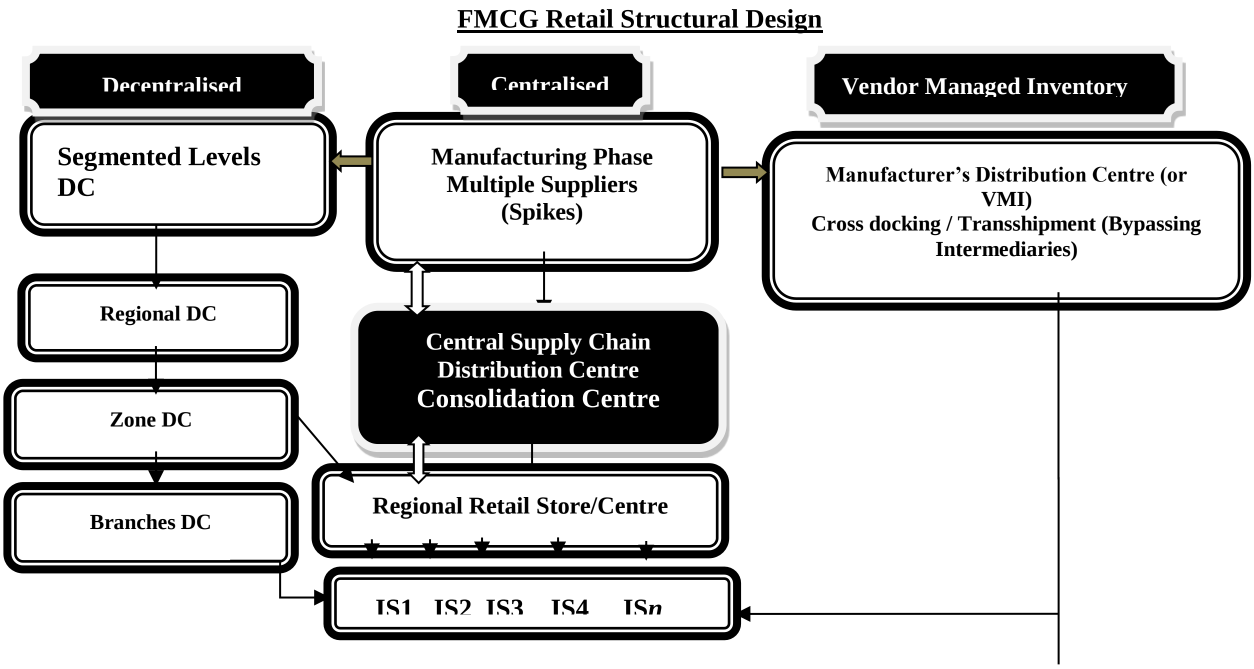
response (Aberdeen Group, 2010). Supply chains require retailers and vendors to work together to synchronise the flow of products and information by investing resources in personnel and technological systems. Durham (2011:11) describes a CscD system as "the standard modus operandi for the fast moving consumer goods industry through the benefits of a fully efficient streamlined supply chain, it reduces out-of-stock at store level, reduces stock room space requirement, manages larger volumes through the central facilities and fewer delivery vehicles at store level with more efficient turnaround time for trucks". In terms of supply chain service management at store level, fewer staff is needed to managed inventory and orders and the focus is on customer service. It is important to improve service levels by linking the flow of product from vendors to individual stores at which customer demand ultimately drives the movement of a product in either of the following structural design:

There are three types of distribution models: a) Segmented levels national DC – Decentralised, b) CscDC (Retail outlets owned DC), and c) Manufacturing DC (Based mostly on VMI system)



M = Manufacturer; IS = Individual Retail Store

Figure 2: Developed by the Researcher (Content Analysis)

The design (figure 2) indicates three possible systems that contribute toward product availability closely at retail store outlets. The purpose of this FMCG retail structural design is to present echelon-based distribution for inventory positioning and order replenishment to make product available closer to customer and tentatively improve customer service. The choice of distribution is scrutinised on the basis of layers to shorten the lead time and enhance information flow. The decentralised system indicates elongated layers with segmented levels of distribution centres. It procrastinates the product availability in closer proximity of customers and dearth of responsive order replenishment. The centralised system indicates fewer layers that formulate consolidated inventory pool and act as an information-based hub in the midstream site of supply chain network. The central supply chain distribution (CscD) system brings simplicity to inbound (suppliers) and outbound product flow (retail outlets) distribution, and enables an integrated supply chain to deliver and sustain the cost-effective availability of a wide product range

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in different stores across broad geographic locations. The most important objective of centralised system with multiple suppliers delivering inventory at the central point is to make product conveniently available close to customers at individual retail outlets with improved customer service.

Central and regional transshipment underpins risk pooling in supply chain management, where the demand variability is reduced by aggregating demand across locations as high demand from one customer will be offset by low demand from another (Simchi-Levi et al. 2008:66). In terms of vendor managed inventory (VMI) system as manufacture-based connotation, it has strong reliance on cross-docking and transhipment, and it manages the phenomenon of bullwhip effect with support of electronic point-of-sale (EPOS). The VMI system allows the supplier or manufacturer to monitor inventory position and replenish customer orders from manufacture's distribution centre (Darwish and Odah, 2010:473-484)

11. Empirical Study

This study investigates the adoption of CscD system among the other systems such decentralised and vendor managed inventory as indicated in figure 2 in this study. This system is anticipated to enhance the operational efficiency by consolidating the retail order replenishment for sufficient inventory positioning in the individual retail stores. It is by nature exploratory and quantitatively attempts to achieve objectives using multivariate methods such as factor analysis and multiple regression analysis. The structural framework of investigation interlinks with the estimable literature review and empirical research paradigm. Apparently, Blumberg, Cooper and Schindler (2008:195) cited Kerlinger (1986:279) that "a research design expresses both the structure of the research problem and the plan of investigation used to obtain empirical evidence on relation of the problem". The empirical research paradigm allows systematic collection of data using scientific questionnaire research instrument after meticulously selecting appropriate sample respondents from the population.

Sampling Technique

The study was conducted using both primary data collected through questionnaires and secondary data acquired from accessible companies' records, archives, books and websites with a view to gaining insight into the industry as a whole. The combination of judgmental (managers and supervisors who understand the CscD system) and convenient sampling were selected as sampling techniques.

A cross-sectional self-administered survey in Durban, KwaZulu-Natal, in South Africa was used for data collection. The target sample frame consisted of FMCG managers and supervisors with insightful knowledge on the industry. The sample size of 335 respondents was conveniently drawn from the target population of FMCG managerial and supervisory staff in the major retail stores. All responses were carefully scrutinised for completeness, consistency and errors, and to eliminate questionable data. The participation was voluntary and completely anonymous. The responses included nominal data (biographical details and general experience in the FMCG sector), as well as ordinal data on a five-point Likert-type scale with end points of "strongly disagree" and "strongly agree" to measure the items. The processing of the data was done by means of the SPSS program to retrieve both univariate, and multivariate results.

Methods

The empirical part of this study is premised on parameters relating to centralised supply chain distribution system diffusion and factors entrenching the effects of the system in the FMCG industry. The univariate technique was used to encapsulate and examine the distribution of cases on one variable at a time. Descriptive statistics on eleven variables relate to the activities in a CscD system. The variables were measured using 5-point scale with 1 = 'Strongly disagree' and 5 = 'Strongly agree'. Factor analysis as a multivariate technique addressed the problem of analysing the structure of the interrelationships (correlations) among a large number of variables by defining a set of common underlying dimensions, known as factors (Hair, et al. 1998). Cooper and Schindler (2008) stress the objective application of this method by clarifying that the predictor-criterion relationship (found in the dependence situation) is replaced by a matrix of intercorrelations among several variables, none of which is viewed as being dependent on another; rather, they are interdependent. Multiple regression tries to establish which set of the observed variables gives rise to the best prediction of the criterion variable.

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12. Development of Survey Instrument

A survey instrument incorporating a list of variables that influence the CscD system was developed based on the literature reviewed from the FMCG industry. The purpose of empirical survey instrument was to capture insightful facts and perceptive responses of the participants on the supply chain distribution systems. It was essential to identify the factors influencing the adoption of centralised or decentralised system specifically to the FMCG industry in South Africa. The quantitative method was used, with self-administered questionnaires to solicit data. A closed-ended set of questions was developed to measure the variables of interest. Part 1 of the questionnaire aimed to gather company information and the personal profile of the participants. In order to measure those items (part II), respondents were asked to indicate their degree of agreement or disagreement with the statements regarding CscD system diffusion using a five-point Likert scale, where 1 represented "strongly disagree and 5 represented "strongly agree".

Table 1: Descriptive statistics on central supply chain system

Items	Mean	Standard Deviation
Service level	4.30	.945
Risk Pooling	4.19	.880
Inventory Management	4.18	.811
Decentralised-Centralised supply system	4.15	.909
Product availability	4.13	.946
Point of Purchase	4.06	1.056
Demand forecast	3.97	.983
Vendor managed inventory	3.87	.971
Seasonal profiles	3.78	.881
Sharing demand data	3.77	1.025
Supply Chain technology	3.73	.904

Table 1 indicates the highest mean score (4.30) for service level with a standard deviation of 0.945. This denotes that service level performance is the main reason for adopting the central supply chain distribution system. As a result of higher service levels, customer satisfaction increases due to reduced lead time and transportation costs. The other variables show the mean scores above four (risk pooling = 4.19, inventory management = 4.18, decentralised – centralised supply chain = 4.15, product availability = 4.13, and point of purchase = 4.06). Although point of purchase has a slightly greater dispersion (standard deviation = 1.056) from the mean, it can be inferred that there is moderate correlation between a central supply chain distribution system and holding inventory closer to the purchase points. Another slightly greater dispersion (standard deviation > 1) away from the mean value (3.77) emerges from sharing demand data (1.025). The mean values for demand forecast (3.97), vendor managed inventory (3.87), seasonal profiles (3.78) and supply chain technology (3.73) are all close to the value of four. Although the supply chain technology has lowest mean score, it is important to align supply chain technology with the centralised system to ensure higher performance and customer satisfaction. These results show that a central supply chain distribution system has the most influence on services levels in order to ensure end-consumer satisfaction in the FMCG industry. It can further be inferred that the majority of respondents are aware of the benefits of a centralised supply chain system in terms of aggregating demand across locations (risk pooling), managing inventory, increasing economies of scale, and improving product availability to meet demand as inventories are held closer to the point of purchase.

Table 2: Descriptive statistics on optimisation strategy towards CscD system

	N	Sigma	$\sigma/\sqrt{n-1}$	Mean	S^2	$\sqrt{s^2}$	Σ Agreed	Neutral	Σ Disagreed	Total
Risk Pooling	335	.040	0.766	4.20	.749	.866	81.21%	15.79%	3%	100%

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Decentralised – Centralised supply chain system	335	.360	0.289	4.16	.813	.901	78.63%	17.55%	3.82%	100%
Inventory positioning	335	.373	0.277	4.14	.669	.818	78.95%	18.05%	3.00%	100%
Vendor managed inventory	335	.857	0.086	3.89	.919	.959	66.17%	26.70%	7.13%	100%

Significant level = 0.05
S^2 = Variance, $\sqrt{s^2}$ = Standard deviation or $(\sigma) = \sqrt{\Sigma fx^2/n - (\Sigma fx/n)^2}$, **Standard Error**= $\sigma/\sqrt{n-1}$, **Sample mean(X_s)**= $\Sigma fx/\Sigma f$

Table 2 indicates that supply chain distribution under aggregated demand across locations (risk pooling) decreases safety stock and average inventory in the system with the highest mean score (4.20), variance of 0.749 and standard deviation (0.855 ≈ 1). The researcher further notes that the overwhelming majority of respondents (81.21%) agreed and a mere 3% disagreed with the statement. Although a small percentage (15.79%) neither agreed nor disagreed, the researcher tentatively accepts that the central supply chain distribution under aggregated demand across location (risk pooling) decreases safety stock and average inventory in the system (sigma: 0.040 < 0.05). This means that there is a statistically significant relationship between risk pooling and central supply chain distribution system diffusion. Another 78.63% of the respondents agreed, 3.82% disagreed and 17.55% were unsure that the move from a decentralised to centralised supply chain system results in increased economies of scale to reduce overhead costs and safety stock with a second highest mean score (4.16), variance of 0.813 and standard deviation of 0.901. The other two variables (inventory positioning and vendor managed inventory) have an average of 4.00 mean score with the majority of respondents agreeing with both statements. However, there is no statistically significant relationship between a central supply chain distribution system and inventory positioning and vendor managed inventory with sigma values greater than significant level (0.05).

13. Factor Analysis

Reliability assessment

The reliability of the instrument was operationalised using the internal consistency method Cronbach' alpha (Cronbach, 1951; Nunnally, 1978). Cronbach's alpha value shows that the constructs are measured with sufficient reliability and the Cronbach alpha of the instrument is 0.849. This figure accords with the minimum of 0.7 suggested by Nunnally (1978) as a rule of thumb and it also confirms the reliability of the instrument, as factor analysis is used to reduce the total number of items to manageable factors.

Factor Analysis

The purpose of factor analysis is to discover discrete dimensions in the pattern of relationships among the variables in the survey instrument. This study provides five reduced number of different factors that are explaining the pattern of relationships among the variables. Helizer, Hollis, de Hernandez, Sanders, Roybal and Van Deusen (2010:223-233) further stress "the nature of the factors, the relationships between the fit of the factors to the observed data, and the amount of random or unique variance of each observed variable". This statistical technique intends to identify a relatively small number of individual factors that can be used to represent relationships among sets of many interrelated variables (Norusis, 1993).

A minimum factor loading of 0.7 was considered to include items as constituents of any factor. Kaiser (1970) stresses that a cut-off value is 0.50 with minimum acceptable level of 0.60 however, a desirable value of 0.80 is meritorious in order to proceed with a factor analysis (Hair at al. 1998:111). The authors add that these guidelines are applicable when the sample size is 100 or larger, and this study has sample size of 335 respondents.

This method replaces the predictor-criterion relationship from the context of a dependence situation into a matrix of intercorrelations among several variables with no dependence (Cooper and Schindler, 2008). The principal component

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analysis ensures the transformation of a set of variables into a new set of composite variables. The researcher intends to retain only factors with 0.7 and above loadings. Factor analysis was performed on the 11 items that constitute the dimensions. Tabachnick and Fidell (2007) maintain that a smaller sample size of 150 cases should be sufficient despite the comforting 300 cases for factor analysis, and solutions should have high loading marker variables. The reliability of factor structures and the sample size requirements are congruent with major factor loading above 0.70. These criteria were met by the present study, with 11 item measures and 335 respondents. The statistical measures have assisted to assess the factorability of the data with Bartlett's test of Sphericity (Bartlett, 1954), and the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Kaiser, 1970, 1974). The measure indicates that the Kaizer-Meyer-Olkin (KMO) score of 0.831 (indicates sampling adequacy) obtained in this factor analysis is suitable with Bartlett's Test of Sphericity (716.098) at degree of freedom (153), significant level, p = 0.000 suggesting that the data matrix has sufficient correlation to factor analysis. The factor model indicates five distinct factor loadings without any misclassifications (a total of eleven items are reduced to five underlying factor loadings).

Table 3: Rotated Component Matrix and Total Variance Explained

Items	Component 1	2	3	4	5	Labelled Factors
Product availability	.827					**Product and service Chain Management**
Service level	.748					
Point of purchase	.721					
Inventory management		.727				**Central supply chain Management**
Decentralised-Centralised supply system		.717				
Risk pooling		.702				
Seasonal profiles			.838			**Seasonal supply chain Management**
Supply chain Technology			.698			
Sharing demand data				.745		**Information sharing Management**
Vendor managed inventory					.793	**Demand chain Management**
Demand forecast					.737	

*Only factors with **0.70** loading for regression.*
***Extraction Method:** Principal Component Analysis*
***Rotation Method:** Varimax with Kaiser Normalisation*

Component	Extraction Sums of Squared Loadings Total	% of Variance	Cumulative %	Rotation Sums of Squared Loadings Total	% of Variance	Cumulative %
1	5.729	31.829	31.829	2.624	14.576	14.576
2	1.476	8.200	40.029	2.350	13.055	27.631
3	1.332	7.400	47.429	2.228	12.380	40.011
4	1.165	6.472	53.901	1.826	10.147	50.157
5	1.072	5.956	59.857	1.746	9.699	59.857

Extraction Method: Principal Component Analysis

The principal component methods of factor extraction and varimax methods of rotation generated five factors that account for 59.857% of the variance. Principal components analysis is used to extract factors with eigenvalues greater than one (Podsakoff and Organ, 1986). While Kaiser's rule (Kaiser, 1970) recommends a drop of all components with eigenvalues under 1.0. The varimax method encourages the detection of factors each of which is related to few variables while discouraging the detection of factors influencing all variables (Tabachnick and Fidell, 2007). Varimax

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rotation is used to facilitate interpretation of the factor matrix because it seeks the rotated loadings that maximise the variance of the squared loadings to make some of these loadings as large as possible. Factor 1 accounts for 31.829%, factor 2 for 8.200%, factor 3 for 7.400%, factor 4 for 6.472% and factor 5 for 5.956% of the variance. Table 4 indicates that these five factors accounted for 59.857% or 60% of the variance in the original eleven variables. The percentage equates the minimum amount of variance of 60% and the original variables have been reduced from 11 to five. All five factors have eigenvalues above the customary cut-off point of one and the factors are set out in Table 3. It is easier to interpret the factor solution if factor loadings under < 0.50 in the factor matrix are not reflected.

Naming of the Factors

The logic of naming the factors has been more easily supportable and theoretically sound. However, the ultimate goal is to derive a set of factors that are theoretically meaningful, relatively easy to interpret, and account for as much of the original variable as possible. The process is subjective and it combines logic and intuition with an assessment of the variables within the context (the CscD system) that have high loadings on each factor. Therefore, factor one is related to “Product and service Management”, factor two is related to “Central supply chain Management”, factor three is related to “Seasonal supply chain Management”, factor four is related to “Information sharing Management” and factor five is related to “Demand chain Management”.

Factors are described as follows:

Factor 1, product and service chain management (PscM), was measured by asking respondents if the CscD system improves product availability while reducing inventory costs and lead times; if the system increases service level performance and end-consumer satisfaction; and if the system meets consumer demands as inventories are held closer to the point of purchase. The product availability and efficient replenishment in individual retail stores seem to be essential for end-consumer’s needs as upstream suppliers ensure on-time deliveries. Cachon and Terwiesch (2009) note that CscDs have the potential to allow manufacturers (source of production) and raw material suppliers (tiers spikes) to meticulously plan their capacity and demand forecast within a central location (either a retailer or manufacturer’s central distribution system) and retailers can ensure on-time delivery of customer orders and minimal stock. As the electronic point-of-sale technology triggers orders in real-time, CscD system accurately updates on-stock position in each retail store to avoid creating surges in demand sometime due to price cutting and promotional campaigns (Heizer and Render, 2011), and to improve product availability (Monczka et al. 2009).

Factor 2, central supply chain management, was measured by asking respondents if they use the CscD system to minimise the system-wide costs of managing inventory; whether a move from a decentralised to centralised supply chain system has higher economies of scale to reduce overhead costs and safety stock; and if the system under aggregated demand across locations (risk pooling) decreases safety stock and average inventory in the system. These statements can be interpreted as the cost efficiency and effectiveness in terms of consolidating order replenishment and aggregation of inventory in the central distribution location to facilitate sharing demand information.

Factor 3, seasonal supply chain management, was measured by items that included the utilisation of seasonal profiles to identify the peaks and valleys within the selling season; and alignment with a comprehensive range of supply chain technology on incremental value. The integrity of consumer demand and order replenishment information could be retained through advanced supply chain technology to increase transparency throughout the chain and better control inventories and product flows. Li, Yang, Sun and Sohal (2009:128) substantiate that integrated supply chain technology has capability to provide timely, accurate and reliable information in which the costs of transacting will be reduced amongst the trading supply chain partners.

Factor 4, information sharing management, was measured by asking respondents if sharing current demand data with the central distribution centre is enough to mitigate the bullwhip effect. The importance of electronically-enabled supply chain management can be expected to entrench the advanced information sharing system and facilitate product availability closer to the end-user customer. Chopra and Meindl (2007: 495) stress that information exchange and technology optimise the chance of trading supply chain partners making the best supply chain decisions. Thiesse and Fleisch (2008:533) note that radio frequency identification (RFID) provides information that helps visualise and control even weakly structured

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processes in real-time in order to achieve a high level of supply chain performance.

Factor 5, demand chain management was measured by asking respondents if vendor managed inventory (VMI) allows suppliers to manage inventory all the way down to the retailer's shelves, and if suppliers can correctly forecast demand trends with a single central distribution centre. The integrated information system seems to provide visibility and a supply chain that ensures fast replenishment of goods in stores from either a retail distribution centre or through VMI system. Dong, Xu and Dresner (2006:360) add that VMI system reduces product demand uncertainty for upstream firms and achieves accurate forecasts (Darwish and Odah, 2010) by communicating real-time data for precise customisation of needs of individual retail stores. In the same view of demand chain management, Yao and Dresner (2006), and Van Wheel (2005) concur that VMI is a continuous replenishment program for exchanging information necessary for retaining just enough products to meet customer demand.

Dimensionality

The factor analysis in this study has produced multiple dimensions where each dimension is reflected by a separate factor, and ultimately names those factors. This means that items are strongly associated with one another, represent a single concept, and produced five dimensions. The test of unidimensionality is that each summated scale consists of items loading highly on a single factor because it facilitates the naming of factors. Table 3 shows highly loaded items on each scale and each item is summated on the basis of high loadings.

Homoscedasticity and Heteroscedasticity

Heterogeneity of the respondents has shown a share variance among variables as the underlying component factor models in Table 3. The first factors have represented those variables that are more homogeneous across the entire sample in the factor analysis. Furthermore, the higher loadings and rotation of the factors have improved interpretation and naming of factors.

14. Multiple Regression Analysis

The study entered all eleven variables that indicated an acceptable loading in the factor analysis method (Cooper and Schindler, 2008:546). The results of multiple regression show the overall explanatory power of all predictor variables with measures of R^2 or adjusted R^2 (that indicate the amount of variance in the outcome explained by all predictors taken together), along with the relative importance of individual predictors after calculating the β coefficients. The method allows the researcher to predict the score on one variable on the basis of their scores on several other variables. In the summary statistics for model 1, product availability explains 5.8% of the system; model 2 increased by 3.8% when sharing demand data (9.6%) is added. The variables were removed for each step in entering the equation, and nine variables are statistical insignificant (range between 0.089 and 0.958) with smaller correlation values.

Multiple regression analysis is an analytical tool designed to explore all types of dependence relationships. Cooper and Schindler (2008:546) describe this dependency technique as tool to develop a self-weighting estimating equation by which to predict values for a criterion variable (dependent variable) from the values for several predictor variables (independent variables). Sekaran (2006) defines multiple regression as an analysis where more than one predictor is jointly regressed against the criterion variable. The purpose of multiple regression analysis is to assess how much of variance in the dependent variable is explained by independent variable. This method incorporated eleven variables to understand the possible predictor variables with potential contribution to the dependent variable in the model of the study. The relationships between independent variables and dependent variable using R, R-square, *F* statistic and significance level are interpreted to understand how much of the variance in the dependent variable in explained by a set of predictors.

According to Nusair and Hau (2010: 315) the values of R^2 or adjusted R^2 indicate the amount of variance in the outcome explained by all predictors taken together. The tests (*t*-test and *F*-ratio) will allow the determination of the statistical significance of the results, both in terms of the model itself, and the individual independent variables. In the same model, the major assumptions for multiple regression are described to evaluate potential problems or disclose the probable violation of assumption in the model with regard to multicollinearity and homoscedasticity.

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Table 4: Model Summary, ANOVA and Coefficients

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics: R Square Change	F Change	Df1	Df2	Sig. F Change
1	.241[a]	.58	.50	1.053	.58	7.680	1	334	.006
2	.311[b]	.96	.82	1.035	.38	5.290	1	335	.023

a. **Predictors:** (Constant), Product availability
b. **Predictors:** (Constant), Product availability, Sharing demand data
Y = Centralised supply chain distribution system diffusion, X_1 = Product availability, X_2 = Sharing demand data

ANOVA

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	8.512	1	8.512	7.680	.006
Residual	138.543	334	1.108		
Total	147.055	335			
Regression	14.181	2	7.091	6.617	.002
Residual	132.874	333	1.072		
Total	147.055	335			

Coefficients

Model	Unstandardized Coefficients		Standardized coefficients	t	Sig.	95% Confidence Interval for Bound		Collinearity Statistics	
	B	Std. Error	Beta			Lower	Upper	Tolerance	VIF
(Constant)	2.218	.420		5.277	.000	1.386	3.050		
Product availability	.275	.099	.241	2.771	.006	.079	.471	1.000	1.000
(Constant)	1.518	.514		2.955	.004	.501	2.534		
Product availability	.255	.098	.223	2.602	.010	.061	.448	.992	1.008
Sharing demand data	.208	.090	.197	2.300	.023	.029	.387	.992	1.008

Equation may now be constructed as: $Y = 0.515 + 0.255 X_1 + 0.208 X_2$

The information in the model summary in Table 4 indicates predictive models (two models) of CscD system are derived by multiple regression analysis unstandardised coefficients using the stepwise procedure for eleven possible explanatory variables. The validity of the final model is assessed by considering the correlation of coefficients and determination, and thoroughly examining the consistency between the model and response results through *t*-test and *F*-test without assuming the superiority of the model from a high value for the coefficient regression. The correlation coefficient for model 1 appears to be low (R^2 = 0.058) while models 2 is revealing value of R^2 = 0.096 showing improvement from model 1with moderate value. The high values of R^2 wouldn't necessarily have indicated the superiority of any model without establishing the validity of models through statistical tests.

This study has included product availability and demand data sharing from model 1-2 with adjusted R^2 values of the variance being explained and accounted for 5.0% and 8.2% respectively. Gujarati (2006: 229) recommends using adjusted R^2 across the board because it explicitly takes into account the number of variables included in the model, computed as: Adjusted R^2 = 1- [(1-R^2)(N-1/N-k-1)]. The *t*-test values are showing the importance of a variable in the model on the value greater than 1.96 with product availability (*t*-value = 2.602, *p* = 0.010) and sharing demand data (*t*-value = 2.300, *p*

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= 0.023) at the significance level less than 0.05. The *t*-value of a coefficient is the coefficient divided by the standard error, and the coefficient is significantly different from zero. All t-test values are appropriate with t-significance values less than 0.05 to consider each variable significant to the valid model. The citation of *F* ratios and *t*- ratios with associated *p*-values, along with the adjusted R squares indicate the significance and strength of the model whether or not there is a linear relationship between CscDs and explanatory variables taken together. The multiple regression analysis describes the effect of the two explanatory variables acting jointly on the CscDs diffusion.

The full model (model 2) shows the proportion of variance accounted for by the model and the significance of the predictor variables (adjusted R square = 0.082, $F_{2,333} = 6.617$, *p*-value = 0.002 less than 0.05). *F* is a function of R^2, the number of independents, and the number of cases in terms of computation of *F*-test by Larzelere and Mulaik (1977) as follows: $F = [R^2/k]/[(1-R^2)/(N-k-1)]$. Adjusted R square value of 0.082 has accounted for 8.2% of the variance in the criterion variables to indicate the strength of the model while F-ratio cites on the significance of the model with associated significant *p*-value. The regression equation appears to be useful for making predictions although the values of R^2 are not explicitly close to 1. In the model quality measure with 100 times adjusted R^2 into whole percentage terms, the accuracy for continuous dependents should be interpreted as the percent of variability in the dependent explained by predictors in the model (Norusis, 2012: 278).

The beta regression coefficient is computed to allow the researcher to assess the strength of the relationship between each predictor variable to criterion variable as β coefficients range from -1.00 to +1.00 (Tabachnick and Fidell, 2007). Table 4 indicates the standardised beta coefficient that product availability (0.223) contributes the most to explaining the relationship between the dependent (central supply chain distribution adoption) and independent variables (product availability and sharing demand data). The standardised betas are 0.223 for product availability (initially for first model has 0.241) and 0.197 for sharing demand data. The beta (β) value is a measure of how strongly each predictor variable influences the criterion variable as units measured by standard deviation. Thus, the higher the beta value the greater the impact of the predictor variable on the criterion variable. The standardised beta coefficients give a measure of the contribution of each variable to the model. The model emerged with two positively significant predictor variables product availability ($\beta = 0.223$) and sharing demand data ($\beta = 0.197$), $p < 0.05$).

In terms of multicollinearity, the tolerance values aim to measure the correlation between the predictor variables and can vary between 0 and 1, while VIF is the reciprocity of tolerance in which a large value indicates a strong relationship between predictor variables. Since neither of the predictor variables has a variance inflation factor greater than ten (both equal to 1.008), there is no apparent multicollinearity problem. In other words, there is no variable in the model that is measuring the same relationship as is measured by group of variables with tolerance scores (0.992) more than 0.20 or 0.10 (O'Brien, 2007). Additionally, using the guidelines for assessing tolerance (less than 0.2) and VIF (greater than 5.0) suggested by Menard (1995), there was no evidence of multicollinearity in any of the models.

Both variables are reasonably acceptable predictors that should be considered in trying to understand what influences the adoption of a central supply chain distribution system in the FMCG industry. These variables are statistical significant at 0.05, product availability (0.010) and sharing demand data (0.023). Thus an equation of the form $Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$ summerises in mathematical terms that X_1 and X_2 are predictors of Y where X_1, β_1 and β_2 are constants. Regression is the method of estimating the parameters and these are referred to as regression parameters. Substitute from Table 5: $Y = 0.151 + 0.255\ X_1 + 0.208\ X_2$. It denotes the following: Y = Central supply chain distribution system adoption, X_1 = Product availability and X_2 = Sharing demand data.

Validity

Convergent validity assesses the degree to which dimensions measures of the same concept are correlated. High correlations indicate that the scale instrument is measuring its intended construct. Thus, items of the scale instrument should load strongly on their common construct (Byrne, 2001). Higher variance extracted values denote that the indicators are truly representative of the latent construct, providing satisfactory evidence of convergent validity and unidimensionality of each construct. To test for construct validity, the variables in the scale were subjected to a principal component factor analysis with varimax rotation in order to obtain a simple structure. Although five components achieved eigen-values > 1, with total

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explained 59,857% of the variance. No clear interpretable pattern emerged from the analysis as there were multiple variable loadings under various components.

15. Discussion and conclusion

The study contemplates to explore the adoption of CscD system in relation to the degree of product availability and consolidated retail order replenishment in stores for end-consumer satisfaction. When this study assessed the average responses and the dispersion of the distribution by describing single variable, the adoption of CscD system indicated the most important influence on the service level performance to satisfy the end-consumer in the FMCG industry. This result is underpinned by the benefits of CscD system in terms of aggregating demand across locations (risk pooling) and consolidating the order replenishment to better manage inventory with increased economies of scale. The shift from decentralised to centralised supply chain is enhanced through electronic point-of-purchase to improve product availability as inventories are held close to the individual retail store.

This study further examined the intercorrelated dimensions in CscD system diffusion whether the elliptical number of items produces the meaningful constructs of factors. The set of factors is theoretically meaningful accounted for 59.857% of the variance in the original variables. The factor analysis approach is grouping the product availability, service level performance and point-of-purchase in one factor loading. While the move from decentralised to centralised supply chain system, inventory positioning and risk pooling were also grouped in the same factor loading. These results are producing the congruence to the findings from descriptive statistical analysis.

The researcher sought to understand the relationship between the effect of CscD system adoption and the magnitude of consolidated product delivery for elongated availability to integrated electronic supply chain management systems. It is essential to establish whether these results would be statistically significant and eventually explains the relationship between the dependent variable and independent variables. Nevertheless, this study indicates the linear relationship between CscD system and product availability and demand data sharing. The adoption of CscD system can tentatively enhance the product availability to provide better service level performance in the individual retail stores. Additionally, the shift from decentralised to centralised supply chain system has propensity to aggregate the consumer demand orders and tentatively facilitate demand data sharing through the support of electronic point-of-purchase and integrated supply chain technology systems. An electronically-enabled central supply chain distribution system can greatly increase the speed with which information on customer demand is disseminated throughout the supply chain, giving rise to more accurate forecasts.

The sharing of planning and forecasting information on the inventory translates into having more of the inventory that customers demand and less of the inventory they do not want at individual retail outlets (Simch-Levi et al. 2008). In terms of collaborative order replenishment among supply chain trading partners, the central distribution centre or store-level-point-of-sale seems to transcend the traditional silo-oriented and legally contracted boundaries of entities along the supply chain and views the entire chain as a closely synchronised, single entity (Chopra and Meindl 2007). The improvement in supply chain customer service performance can be attributed to the reduced lead time and transportation costs as a result of central supply chain configuration.

It can be tentatively recommended that the CscD system makes products available in the supply chain network using integrated information sharing and technology systems to improve business efficiency. It is also noted that the agile CscD system with advanced supply chain technology needs to be supported by a fully integrated information system that provides visibility of the whole supply chain for fast replenishment of goods in stores customised precisely to the needs of individual retail stores.

The possible benefits are assumed to be emulated through the performance of supplier's pre-allocation cross-docking and DC's pre-merchandising activities that are carried out at the CscD centre before the stock arrives at the retail outlets. The system should work like a hub-and-spoke in which goods are centrally ordered, pre-packaged from suppliers or assembled at the distribution centre (hub), and these goods are dispatched (or pre-merchandised) to the individual retail outlets (spoke).

16. Limitations and future areas of study

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The notable limitation of the study is that it is a cross-sectional survey of a specific industry. This survey method limits the ability to observe the extended organisational developments and benefits over time after the adoption of a CscD system. The FMCG industry (only major South African retail stores) is a potential source of common method variance and basis for analysis without extensive generalisability of the survey findings. The study was done in one location, Durban in the KwaZulu Natl province and that it might differ for other locations and provinces within South Africa. Despite the significant contribution to the body of knowledge (academically and in terms of industry practice) by this study, a future research avenue would be a cross-country collaborative design to capitalise on the recent expansion of South African FMCG retail stores across the African continent.

Turning to the human factor, a future study could explore the relationship between the adoption of a CscD system and staff concentration on core activities and productivity improvements. If the distribution centre carries out the pre-merchandising activities and suppliers provide pre-allocation cross-docking, retail store staff is expected to concentrate on customers. A positive shift in their focus might lower staff turnover and improve job satisfaction and morale.

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