“Differentiating supply chain strategies: the case of light vehicle manufacturers in South Africa”

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Differentiating supply chain strategies: the case of light vehicle manufacturers in South Africa

Abstract

This article reports on an investigation of supply chain strategies that are employed by light vehicle manufacturers in South Africa. The research method used was an exploratory and descriptive study. A face-to-face, semi-structured interview questionnaire was administered to senior supply chain practitioners, based on purposive sampling and the data was analyzed descriptively using SPSS software. The findings of the study revealed that both lean and agile supply chain strategies are employed by the manufacturers. All the light vehicle manufacturers followed a lean strategy for their inbound supply chain. While a few of them followed a lean supply chain strategy for their outbound supply chain, others followed an agile supply chain which suggests a leagile supply chain strategy. Three important conclusions can be drawn from the study. Firstly, despite the changing business conditions and increased customer demands, lean supply chain strategy is still the dominant strategy for light vehicle manufacturers in South Africa. Secondly, a supply chain strategy is not all about product characteristics as a determining factor. There are other criteria that could be used to determine supply chain strategies. Finally, light vehicle manufacturers do not always make decisions and implement practices in line with their chosen supply chain strategies. Hence, there are mismatch between practices and strategies. It is recommended that the vehicle manufacturers align their practices with their chosen strategy, since mismatching generally leads to problems and challenges in organizations.

Keywords: South Africa, light vehicle manufacturers, supply chain management, strategies.
JEL Classification: M00.

Introduction

In the 21st century, developing trends in international arena has forced many organizations to revisit their supply chain strategies. Supply chain strategies are pivotal to the success of most contemporary business organizations (Wu, 2008, p. 3). Traditionally, supply chains were geared towards leaner process approaches in an effort to increase supply chain efficiency (reducing costs and eliminating inefficiencies) (Swiecki and Gerth, 2008, p. 2). Henry Ford laid down the foundation of mass production technique by introducing assembly line mass production; followed by a more decentralized organizational structure initiated by Alfred P. Sloan which helped General Motors offer broad portfolio to their customers. Thereafter the lean production models established by Japanese automotive industry (especially Toyota), gave tough competition to rivals in the USA and Europe. These approaches were based on the "Lean production philosophy" which offers better deal to customers in terms of cost and quality (Holweg, 2008).

However, owing to vulnerability and turbulence in the business environment, lean as a supply chain strategy can no longer cope with changing business conditions (Cox, Chicksand and Palmer, 2007, p. 690). Today, organizations offer wide range of products to different markets, different customer segments and preferences with high variation in demand. Swiecki and Gerth (2008, p. 2) asserted that the characteristics of the traditional downstream supply chain (lean) do not make provision for responding to the changing business environment. Hence, lean is not a universal solution to meet all the needs of the supply chain. Organizations such as Dell computers, Compaq and BMW have built responsive supply chains necessitated by fierce competition, fluctuating market demand and rising customer requirements resulting to increased preferences. Christopher, Peck and Towill (2006) profound that supply chain strategies need to be tailored to match the specific demand characteristics of a product, product family or market. It is not enough to employ a traditional "one-size-fits-all" supply chain strategy (Hilletofth, 2009). Instead, it has become increasingly necessary to employ several supply chain solutions concurrently. It is therefore of growing importance to develop a differentiated supply chain strategy to stay competitive.

In this light, Fisher (1997) asserted that a mismatch between practices and strategies is the root cause of the problems plaguing many supply chains; and, therefore, supply chain strategies that are based on a one-size-fits-all strategy will fail. A good supply chain strategy must be aligned with a company's business strategy (Chaudhary, 2008, p. 31) since a mismatch generally leads to significant problems in business operation (Lo and Power, 2010, p. 140). In South Africa, the automotive industry is the leading industry in supply chain practices (Supply-chainforesight, 2010). The industry is often referred to as a barometer for the health of the country's economy [7% of GDP for 2012 (Automotive Industry Export Council [AIEC], 2013)]. Vehicle manufacturers face enormous supply chain

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challenges which include the establishment of cost reduction measures and service improvement (Supplychainforesight, 2007). The majority of companies in the industry do not only operate with low levels of collaboration, but are also not very market-sensitive or reactive to the changing market (Supply Chain Intelligence Report [CSIR], 2009). Therefore, an efficient and responsive supply chain strategy is required for South African automotive industry manufacturers who assembled variants of vehicles for local and international markets to produce at a competitive cost and to respond quickly and reliably to first-world market demands.

Numerous amounts of research have been conducted on supply chain strategies in various industries and sectors including the automotive industry. However, little research to the researcher's knowledge has been conducted in the South African automotive industry on differentiating supply chain strategies. Because the industry is so important to the South African economy, it is imperative that a research be conducted to investigate the types of strategies or combinations of supply chain strategies employed by manufacturers. Hence, this article investigates supply chain strategies employed by light vehicle manufacturers in South Africa (only local manufacturers). This study depicts the state of application of supply chain strategies among light vehicle manufacturers in South Africa. Furthermore, it revealed that there are mismatch between practices and strategies of the vehicle manufacturers. The paper is organized as follows. Section 1 presents the theoretical review. Section 2 gives the research methodology. Section 3 reveals the results and discussion. The final section concludes the paper.

1. Theoretical review

This section of the article presents the theoretical review. In this section, three ways to differentiate supply chain strategies are established.

1.1. Supply chain management. Supply chain management (SCM) is vital for the success of organizations as they need to respond to increasing levels demand volatility. SCM has gained recognition as a powerful tool that gives companies the opportunity to achieve competitive advantage (Christopher, 2005, p. 6). Hugo, Badenhorst-Weiss and Van Biljon (2004, p. 5) asserted that SCM looks for opportunities to generate revenues for the organization and potentially increase their market share by providing customers with the products or services they need. The objective of SCM is to achieve a sustainable, competitive advantage. According Leenders and Fearon (2004, p. 10), "SCM is the systems approach to managing the entire flow of information, materials and services from the raw materials suppliers through factories and warehouses to the end customer". Christopher (2005, p. 5) defined SCM as "the management of upstream and down-stream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole". Gansler, Luby and Kornberg (2004, p. 8) noted that SCM is the management and control of all materials, funds and related information in the logistics process from the acquisitioning of raw materials to the delivery of finished products to the end user. These definitions of SCM represent different views in many literature sources; and can, to some extent, be classified in three categories: a management philosophy, implementation of a management philosophy, and a set of management processes.

1.2. Supply chain strategies. A supply chain strategy is part of the overall business strategy, designed around a well-defined basis of competition (innovation, low cost, service, quality) (Hines, 2006, p. 33). It is integrated with the marketing strategy; customers' needs; the product strategy; and power position. There are two generic strategies in SCM, namely the lean and agile strategies. "Lean" is a supply chain term defined as the "enhancement of value by the elimination of waste" (Womack and Jones, 2003). A lean supply chain is concerned with cost reduction by operating the basic processes with a minimum of waste (Qi, Boyer and Zhao, 2009, p. 670). The primary objective of a lean supply chain can be realised by using the most basic forms of data communication on inventories; capacities; and delivery plans and fluctuations within the framework of just-in-time (JIT) principles (El-Tawy and Gallear, 2011, p. 817). Agility, on the other hand, is a comprehensive response to the business challenges of profiting from rapidly changing, continually fragmenting global markets for high-quality, high-performance, customer-configured goods and services (Iskanius, 2006, p. 93). Agility in the context of SCM focuses on 'responsiveness'. Li, Chen, Goldsby and Halsapple (2008, p. 408) professed that, in today's complex and challenging supply chains, agility is critical to global competitiveness. An agile supply chain strategy is the ability of the supply chain as a whole, and its members, to rapidly align the network and its operations with the dynamic and turbulent requirements of the customers (Duarte and Machado, 2011, p. 331).

Despite the distinguished characteristics of lean and agile systems, the two can be combined to form a hybrid system called "leagile" supply chain. This system can be defined as "a system in which the advantages of leanness and agility are combined" (Christopher et al., 2006). Leagile supply chains aim to infuse competitiveness in an organization in a

cost-effective manner. The combination of lean and agile paradigm in a total supply chain strategy by positioning the decoupling point to best suit a need (Rahimnia and Moghadasian, 2010, p. 81). In this hybrid strategy, 'lean' focuses on waste elimination, achieving low-cost delivery of a standardized and stable product, while 'agility' responds to complexity brought about by constant and unpredicted changes.

1.3. Framework for differentiating supply chain strategies and research questions. Fisher (1997) developed a model that helps managers determine their supply chain strategies based on the nature of the product (functional and innovative products). However, supply chain strategy is more than a product strategy. Supply chain dynamics are important to understand change in supply chain strategy. Scholars have contributed extensively to Fisher's model and have suggested that, in addition to the 'product', there are other factors that might influence the choice of a supply chain strategy (Lo and Power, 2010, p. 141). Lee (2002, p. 106) asserts that a strategy can be chosen by determining supply and demand characteristics (evolving versus stable supply). Chopra and Meindl (2010, p. 44) believe that a trade-off between efficiency and responsiveness is required to determine a supply chain strategy. Other criteria for determining a supply chain strategy include replenishment lead times (short or long) (Christopher et al., 2006, p. 282); the specific 'market winner' criterion (Christopher and Towill, 2002, p. 9); the product life cycle (PLC) (Fawcett, Ellram and Ogden, 2007, p. 222); and the nature of push and pull-based supply chains (Simchi-Levi, Kaminsky and Simchi-Levi, 2003). Duarte and Machado (2011, p. 329) asserted that 1) the structure; 2) organizational relationships; and (3) the process (Sayuti, 2011, p. 288) are essential determinants of a supply chain strategy. Narasimhan and Kim (2002, p. 303) emphasize that the nature of the business; the competitive environment; technology; and product and market characteristics are also fundamental determinants of supply chain strategies. Agarwal, Shankar and Tiwari (2007, p. 443) state that information technology, centralized and collaborative planning, and process integration are equally important determinants of an optimal supply chain strategy. This article articulates three dimensions by which supply chain strategies can be determined. The dimensions and specific attributes are illustrated in Figure 1 and include the relationships between the product characteristics, manufacturing characteristics and decision drivers of supply chain.

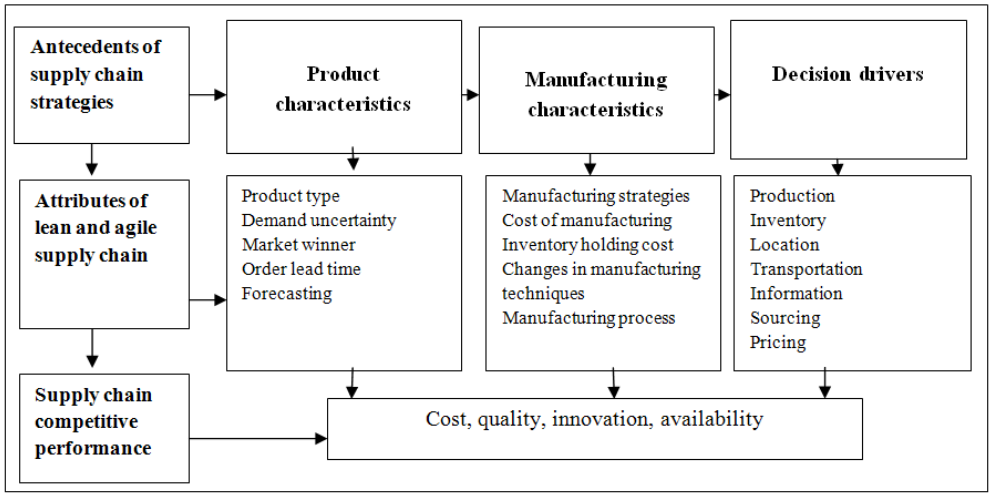


Fig. 1. Theoretical framework for supply chain strategies

As indicated in Figure 1, supply chain strategies can be determined from the relationships between a range of variables. These variables are discussed below:

1.3.1. The relationship between product characteristics and supply chain strategies. The Fisher (1997) model helps managers to understand the nature of their products and devises the supply chain that can best satisfy a particular demand (Jacobs, Chase and Aquilano, 2009, p. 362). According to the model, a supply chain strategy is established based on the product type (functional or innovative products) (Fisher, 1997, p. 107). For functional products, demand is predictable and stable over time, while for innovative products the product lifecycle is short and demand is unpredictable. Fisher's (1997, p. 106) model considers the differences between the products as the main factor in establishing the right supply chain strategy. Because these two product profiles experience different costs, each of these categories requires distinctive supply chain strategies. Due to its demand characteristics, a functional product should focus on achieving the lowest possible cost and, therefore, have a supply chain strategy oriented towards efficiency (Jacobs et al., 2009, p. 362). An innovative product, on the other hand, must use a responsive strategy that is oriented towards reducing

lead times and postponing product customization in order to respond quickly to unpredictable customer demand (Jacobs et al., 2009, p. 362).

Because of their substitutability, functional products tend to have price as their market winner (the customer can, easily buy a nearly identical product from a competitor), while product quality, lead time and availability are market qualifiers (Christopher and Towill, 2002, p. 10). In contrast, availability (and inherently service level) is the market winner for innovative products, with quality, price and lead time as the market qualifiers. That is, you cannot acquire a share of an innovative product's market unless the product is available for the public to purchase and has supporting high levels of service (Mason-Jones, Naylor and Towill, 2000, p. 55). The two product types respond to different marketplace pressures. Functional products have a predictable demand pattern and customers who expect the lowest costs. Innovative products have volatile demand with customers who expect that supplies will be available to meet their demand (Mason-Jones et al., 2000, p. 56). In reality, many products demonstrate features of both functional and innovative products, and there is a continuum scale with the extremes at either end. According to Fisher (1997, p. 106), functional products require a physically efficient supply chain while innovative products require a market responsive supply chain. The product life cycle for functional products is more than two years, while for innovative products; it is three months to one year. Functional products have a low product variety of 10 to 20 variants per category while product variety is high for innovative products. Moreover, the make-to-order lead time for functional products is six months to a year, while for innovative product; it is one day to two weeks. Table 1 shows the characteristics of products used in this article and the effect on supply chain strategies.

Table 1. The relationship between product characteristics and supply chain strategies

Product characteristics	Lean supply chain strategy	Agile supply chain strategy
Type of product	Standard (functional products)	Customized (innovative products)
Order lead time	Long order lead time (six months to one year)	Short order lead time (one day to two weeks)
Demand uncertainty	Predictable demand	Unpredictable demand
Market winner	Cost	Availability
Product life cycle	Long (more than two years)	Short (three months to a year)
Forecasting	Relatively accurate	Demand driven
Product variety	Low (10 to 20 variants per category)	High (often millions of category per variants)

Research question 1: What is the supply chain strategy of light vehicle manufacturers in South Africa based on the product characteristics?

1.3.2. The relationship between the manufacturing characteristics and supply chain strategies. Typical techniques in marketing strategies are classified as being mass, sequential and focused or one-on-one (Bowersox, Closs and Cooper, 2010, p. 87). These strategies are differentiated in parts, in terms of the deserved degree of product and service accommodated. The foundation for determining the relationship between manufacturing characteristics in this article is based on identifying four representative supply chains that are appropriate for different manufacturing environments. These include make-to-stock (MTS), assemble-to-order (ATO); configure-to-order (CTO); make-to-order (MTO); design-to-order (DTO) or engineer-to-order (ETO). In a MTS supply chain, the end consumer has no individual inputs in the configuration of the product, and typically purchases the product as is from a retailer. MTS supply chains are extremely common, because they are appropriate for high-volume, low-profit margin, commodity products (Jonsson, 2008, p. 153). These low-cost products tend to have a relatively stable demand, which can be forecasted with a low degree of error when accurate historical demand information is available (Stavrulaki and Davis, 2010, p. 134).

A CTO supply chain provides customers with a limited number of choices in the configuration of the final product. Customers can pick and choose from various standard components that are available to produce their own products, but have no control in determining the design of these components at individual level. In order to offer customers a number of options, companies typically delay the final assembly of products until orders are received (Jonsson, 2008, p. 153). CTO supply chains are typically appropriate for higher priced consumer goods that are assembled to individual end customer specifications. The MTO supply chain affords consumers the opportunity to have at least some part of the product uniquely built into their individual specifications. At the same time, the end consumer has no input into the overall design of the product, which remains fixed within the design parameters established by the firm. The MTO supply chain delivers customized, relatively expensive products that are specifically built to meet the needs of individual customers, although the actual design specifications have previously been established. These products are low-volume and high-margin

products (Stavrulaki and Davis, 2010, p. 138). Products made with the ETO supply chain represent the ultimate in customization, because there are virtually no constraints on the customers with respect to incorporating their individual preferences and requirements into the final design of the product. Hence, products from ETO are by definition low volume (often volumes of one), with highly variable characteristics, and they have high prices.

All processes in a supply chain discussed above fall into one of two categories: push or pull. In the push process, production of a product is authorized on the basis of forecasting, which is in advance of customer orders (Jonsson, 2008, p. 268). In the pull process, however, the final assembly is triggered by customer orders. In a pure push process, make-to-stock is the primary production approach. Demand is forecasted on the basis of historical sales data. Production lead time is relatively long and finished goods inventory is more than that of the pull system. In the pull approach, end users trigger the production process (Chopra and Meindl, 2010, p. 70). The major production strategy is MTO, CTO, and ETO. In a pull scenario, demand uncertainty is higher and cycle time is shorter than that of the push approach. In this process, the finished goods inventory is minimal (Taylor, 2004, p. 29). Table 2 indicates the alignment of manufacturing characteristics and supply chain strategies.

Table 2. The relationship between manufacturing characteristics and supply chain strategies

Manufacturing characteristics	Lean supply chain strategy	Agile supply chain strategy
Manufacturing strategies	MTS	CTO, MTO, ETO
Manufacturing cost	Low cost manufacturing strategy	Cost is demand-driven (flexibility)
Inventory holding	Minimum inventory in the production process	Hold inventory based on demand specifications (pull by orders)
Changes in manufacturing	Little or no changes (based on projected forecasting)	Make provision for changes in customer demand
Manufacturing process	Push supply	Pull supply

Research question 2: What is the supply chain strategies of light vehicle manufacturers in South Africa based on the manufacturing characteristics?

1.3.3. The relationship between the decision drivers and supply chain strategies. Supply chain strategies directly affect the supply chain decision drivers. The decision drivers examined in the article include the following: production (facilities); inventory; location; transportation; information; sourcing; pricing; supplier selection; alliances; and relationships. The fundamental decision that managers face when making production decisions is how to resolve the trade-off between responsiveness and efficiency (Taylor, 2004, p. 21). If factories and warehouses are built with a lot of excess capacity, they can be extremely flexible and respond quickly to wide swings in product demand. To be responsive, a company can do its production in many smaller plants that are close to major groups of customers so that delivery times are shorter. If efficiency is desirable, a company can build factories with little excess capacity and have the factories optimized for producing a limited range of items. Further efficiency can be gained by centralizing production in large central plants to obtain better economies of scale (Chopra and Meindl, 2010, p. 62).

Inventory is spread throughout the supply chain and includes everything from raw material, and work in process to finished goods that are held by manufacturers, distributors and retailers in a supply chain (Taylor, 2004, p. 22). Managers must decide where they want to position themselves in the trade-off between responsiveness and efficiency (Nel & Badenhorst-Weiss, 2010, p. 210). Holding large amounts of inventory allows a company or an entire supply chain to be extremely responsive to fluctuations in customer demand (Bowersox et al., 2010, p. 157). However, the creation and storage of inventory are a cost, and to achieve high levels of efficiency, the cost of inventory should be kept as low as possible. An organisation can be responsive by stocking high levels of inventory for a wide range of products (Chopra and Meindl, 2010, p. 65). With respect to location, these decisions relate to the activities that should be performed in each facility. The responsiveness versus efficiency trade-off is the decision whether to centralise activities in fewer locations to gain economies of scale and efficiency, or to decentralize activities in many locations close to customers and suppliers in order for operations to be more responsive (Chopra & Meindl, 2010, p. 63). When making location decisions, managers need to consider a range of factors relating to a given location, including the cost of facilities; the cost of labor; skills available in the workforce; infrastructure conditions; taxes and tariffs; and proximity to suppliers and customers. Location decisions tend to be strategic decisions because they commit large amounts of money to long-term plans (Waters, 2003, p. 105).

In transportation decision, the trade-off between responsiveness and efficiency is manifested in the

choice of transport mode (Taylor, 2004, p. 23). Fast modes of transportation, such as aeroplanes, are highly responsive, but also more costly. Slower modes, such as ship and rail, are extremely cost efficient, but not as responsive. Since transportation costs can be as much as a third of the operating cost of a supply chain, the decisions made here are crucial (Jonsson, 2008, p. 64). According to Chopra and Meindl (2010, p. 65), responsiveness can be achieved by a transportation mode that is fast and flexible. Many companies that sell products through catalogues or over the internet are able to provide high levels of responsiveness by using transportation to deliver their products, often within 24 hours (Nel and Badenhorst-Weiss, 2010, p. 211).

Information is the basis on which decisions about the other four supply chain drivers are made. It is the connection between all of the activities and operations in a supply chain. To the extent that this connection is a strong one, the companies in a supply chain will each be able to make sound decisions for their own operations (Jonsson, 2008, p. 90). The power of this driver grows stronger each year as the technology for collecting and sharing information becomes more widespread, easier to use and less expensive. High levels of responsiveness can be achieved when companies collect and share accurate and timely data generated by the operations of the other four drivers (Nel and Badenhorst-Weiss, 2010, p. 211). Sourcing decisions are also crucial because they affect the level of efficiency and responsiveness the supply chain can achieve. Outsourcing certain processes to other parties may increase a supply chain's efficiency, but may reduce its responsiveness, because of possible longer lead time to achieve economies of scale (Nel and Badenhorst-Weiss, 2010, p. 211). Outsourcing decisions should be driven by the desire for growth in total supply chain surplus.

Finally, pricing affects the customer segments that choose to buy the product as well as customer expectations. This directly affects the supply chain in terms of the level of responsiveness required and the demand profile that the supply chain attempts to serve (Chopra and Meindl, 2010, p. 74). Pricing is a significant attribute through which a firm executes its competitive strategy. Customers expect low prices but are comfortable with a lower level of product availability. Steady prices also ensure that demand stays relatively stable. Pricing, therefore, affects the behavior of the buyer of the product, thus affecting supply chain performance. Customers who value responsiveness will pay more for higher levels of customer service (Nel and Badenhorst-Weiss, 2010, p. 211). Table 3 indicates the alignment of the decision drivers and supply chain strategies.

Table 3. Determining supply chain strategies based on the decision drivers

Decision drivers	Efficiency (lean supply chain)	Responsiveness (agile supply chain)
Production	♦ Little excess capacity ♦ Narrow focus ♦ Few central plants	♦ Excess capacity ♦ Flexible manufacturing ♦ Many small factories
Inventory	♦ Low inventory levels ♦ Fewer items	♦ High inventory levels ♦ Wide range of items
Location	♦ Few central locations serve wide areas	♦ Many locations close to customers
Transportation	♦ Shipments few, large ♦ Slow, cheaper modes	♦ Frequent shipments ♦ Fast and flexible mode
Information	♦ Information is used to build master production schedule (forecasts) and create delivery due dates ♦ Cost of information decreases while other costs rise	♦ Information is used on actual demand to be transmitted quickly to reflect real demand accuracy ♦ Collect and share timely, accurate data
Sourcing	♦ Supplier selection criteria based on low prices	♦ Supplier selection criteria based on high service levels
Pricing	♦ Pricing is a key means for balancing supply and demand ♦ Based on low margins and high volumes	♦ Pricing does not normally impact on short-term demand ♦ Based on high margins

Research question 3: What is the supply chain strategies of light vehicle manufactures based on the decision drivers of supply chain management?

2. Research methodology

To find a solution to the research questions, the article is exploratory and descriptive in nature; and consisted of two phases. The first phase of the article was a literature (exploratory) study and the second phase an empirical study (descriptive). In the first phase of the study, literature related to SCM was examined, the problem was defined and research questions and objectives were stated. This provided a clear theoretical framework and formed the basis of the article. The outcome of the literature study was the development of a theoretical framework for determining supply chain strategies. This served as the focal point for the research instrument to be used in the empirical study. The second phase was achieved as follows:

The design and strategy: A descriptive research design was employed among light vehicle manufacturers. The study used a survey as research strategy. A survey is a form of research whereby the researcher interacts with respondents to obtain facts, opinions and attitudes (McDaniel and Gates, 2001, p. 30).

Population and sample: The target population for the study was the original equipment manufacturers (OEMs) in the South African automotive industry (local manufacturers only). South Africa has seven (7) automotive manufacturers who produce two broad categories of vehicles for the local and international markets. These are passenger vehicles and commercial vehicles. Passenger vehicles are classified from A to D class, premium and SUVs, while commercial vehicles are categorized into light commercial, medium commercial and heavy commercial. Passenger vehicle and light commercial vehicles are termed light vehicles. One manufacturer may have various production lines with various supply chain strategies for each one. This is because supply chain strategies are unique to a production line and not the supply chain in general as indicated by Fisher (1997). This study focused on one production line (models) for each of the manufacturers. The population therefore constituted of light vehicle manufacturers (passenger and light commercial vehicles). Light vehicle manufacturers were chosen, firstly, because this would incorporate all the automotive manufacturers in South Africa. Secondly, both categories of vehicle are used for personal purposes and therefore require distinctive features and characteristics. Table 4 presents the various models of passenger and light commercial vehicles assembled in South Africa.

Table 4. Light vehicle manufacturers and local manufactured models in South Africa, 2011

Passenger vehicles (2011)		Light commercial (2011)	
Manufacturer	Models	Manufacturers	Models
BMW	3-series, 4-door	Nissan	Hardbody, NP300, NP200
Mercedes-Benz	C-Class 4-door	Toyota	Hilux
Nissan	Tiida, Livina/Grand Livina	Ford	Bantam and Rangers
Toyota	Corolla 4-door and Fortuner	General Motors	Chev Utility and Isuzu KB
Ford	Icon and Focus	Mercedes-Benz	Mitsubishi Triton

Source: AIEC (2013).

Therefore the article included the following light vehicle manufacturers: BMW, Toyota, Nissan, Mercedes-Benz, Volkswagen and General Motors. Ford Motors South Africa was not part of the study as the company did not participate. These manufacturers are subsidiaries of parent companies in Asia, America and Europe. In this article, total target population (all light vehicle manufacturers in South Africa) was used. A purposive sampling technique was used to determine the respondents. The intention of using purposive sampling was to concentrate on those who have expert knowledge about supply chain practices and operations of the product line in the automotive industry (senior supply chain managers). Therefore, specific participants for interviews were selected according to their strategic positions in the supply chain.

Data collection, methods and analysis: Primary data were collected through face-to-face interview questionnaire (empirical study). The interview questionnaire was measured using a Likert scale format type with end points (1) "strongly disagree" and (5) "strongly agree" as end points. A total of twenty four (24) in-depth interviews were conducted. Each questionnaire was completed for a particular vehicle (model). A total of six (06) model/production were involved in the study. This is because strategies are determined for a product and not for a supply chain. NB: For some manufacturers, senior managers had to complete different sections of the interview questionnaire. In this article, only the structured questions are analyzed and presented. The data were analyzed descriptively, using statistical package for social sciences (SPSS).

3. Results and discussion

As indicated in the literature study, supply chain strategies are based on a particular locally made model (vehicle) or production line. The findings relating to strategies should, therefore, be interpreted for the particular model and are not necessarily applicable to other models manufactured by the same company; and are presented in frequency distribution (in %) per statement and mean level of agreement. The results relating to the research questions are presented and discussed before answering the research objective.

Research question 1: What is the supply chain strategies of light vehicle manufacturers in South Africa based on product characteristics?

In this question, respondents were asked to rate their agreement on statements relating to the characteristics of a product (vehicle model) measured, using a five-point Likert response format

with the end points (1) "strongly disagree" and (5) "strongly agree". The questions comprised five statements and the results are presented, using percentages as indicated in Table 5[1].

Table 5. Responses regarding product characteristics

Statements	Percentage				
	SD	D	N	A	SA
The model is a standard vehicle (no customization)	25.0%	25.0%	0.0%	33.3%	16.7%
The demand for the model (vehicle) is stable	8.3%	8.3%	0.0%	75.0%	8.3%
The market winner (most important sales criteria/point) for the model is cost	16.7%	33.3%	8.3%	16.7%	25.0%
The order lead time (order to delivery) takes more than three months	16.7%	50.0%	25.0%	8.3%	0.0%
Our forecast for the model is relatively accurate	8.3%	0.0%	16.7%	75.0%	0.0%

According to Table 5, half of the respondents (50%) chose the standard vehicle as the model (vehicle). The majority (83.3%) of the respondents agreed that the demand for the model was stable. Half (50.0%) of the respondents disagreed that the market winner (most important sales criteria/point) for the model was cost, while 41.7% agreed. These results mean that South African automotive manufacturers do not only assemble standardized vehicles. Two-thirds (67.7%) of the respondents disagreed that the order lead time (order to delivery) took more than three months. In addition, three-quarters (75.0%) of the respondents agreed that their forecast for the model was relatively accurate. Most of the products thus had a relatively stable demand and a relatively accurate forecasting for their models. Hence, the industry manufactures both functional (standard) and innovative (non-standardized) products, which implies that both the lean and agile supply chain strategies are employed by the manufacturers.

Research question 2: What is the supply chain strategies of light vehicle manufacturers in South Africa based on manufacturing characteristics?

The respondents' perceptions were sought on manufacturing characteristics. This question comprised seven statements. Table 6 indicates the frequency distribution (in % responses) per statement.

Table 6. Responses regarding manufacturing characteristics

Statements	Percentage				
	SD	D	N	A	SA
We have a low manufacturing cost strategy	8.3%	8.3%	8.3%	50.0%	25.0%
We make provision in our manufacturing strategy for customers' demands (specifications)	0.0%	8.3%	8.3%	50.0%	33.3%
We change our manufacturing strategy quickly according to customer demands	8.3%	33.3%	16.7%	41.7%	0.0%
We customize some parts in our production process to meet certain customers' orders	16.7%	25.0%	8.3%	33.3%	16.7%
We keep minimum inventory in the production process	0.0%	0.0%	16.7%	33.3%	50.0%
We manufacture on the basis of projected forecast	0.0%	0.0%	0.0%	66.7%	33.3%
We have a pull system with specific customer orders	8.3%	16.7%	8.3%	33.3%	33.3%

Table 6 indicates that three-quarters (75.0%) of the respondents agreed or strongly agreed that the model had a low manufacturing cost strategy. The majority (83.3%) of the respondents agreed that they made provision in their manufacturing strategy for customers' demands (specifications) for the model. Regarding the statement to determine whether the respondents quickly change their manufacturing strategy according to customer demands for the model, 41.7% of the respondents agreed, while 41.7% disagreed. Half of the respondents (50%) agreed that some parts in the production process for the model were customized to meet the orders of certain customers, while 41.7% disagreed. The majority of the respondents (83.3%) indicated that they kept minimum inventory in the production process of the model. All the respondents (100.0%) indicated that the model was manufactured on the basis of the projected forecast. Two-thirds (66.7%) of the respondents agreed that the model had a pull system with specific customer orders, while a quarter (25.0%) disagreed.

The results show that the majority of the respondents followed a low manufacturing cost strategy for the production line. Hence, the focus of the manufacturing process was on reducing waste while enhancing customer value (lean supply chain). To some extent the manufacturers also followed a MTO strategy based on the demands of dealers. The manufacturers kept minimum inventory in the production process (lean supply chain strategy). The manufacturing process was based on projected forecast. The majority of the respondents used a pull system.

[1] For the purposes of analysis the following abbreviations were used: SD for strongly disagree; D for disagree; N for neither agree nor disagree; A for agree; and SA for strongly disagree

In order to further understand the manufacturing strategy, the respondents were asked to state which of the following strategies they used in the production line of the model, as reflected in Table 7.

Table 7. Strategy used in the production line

Which of the following manufacturing strategies best suit the production line for this model?	Percentage
Make-to-stock (MTS)	58.3%
Make-to-order (MTO)	41.7%

As indicated in Table 7, more than half of the respondents (58.3%) indicated that the manufacturing strategy that best suited the production line (model) was a make-to-stock strategy, while 41.7% indicated that make-to-order was the strategy. The make-to-stock strategy was implemented slightly more, indicating that a lean supply chain was the dominant strategy.

Research question 3: What is the supply chain strategies of light vehicle manufacturers based on the decision drivers of SCM?

The respondents were asked to indicate the extent to which they agreed with statements relating to production, inventory, location, transportation, information, supplier selection and pricing decisions as presented in Table 8.

Table 8. Responses regarding decision drivers of the supply chain

Statements		Mean	Median
Production	We have excess capacity in our production process	2.92	3.00
	We have flexible manufacturing processes	2.91	3.00
Inventory	We work on a strict JIT system and, therefore, keep inventory holding in the production process to a minimum	4.17	4.00
Location	We have decentralized distribution centres (stores) to serve our dealers	2.75	2.00
	Our local strategic suppliers are located close to our production plant	3.67	3.50
Transportation	We make small and frequent shipments to our strategic customers	4.25	4.00
	We receive small and frequent shipments from our strategic suppliers	3.92	4.00
	We make use of the low cost mode of transportation for parts purchase from our strategic suppliers	3.83	4.00
	We make use of the low cost mode of transportation for vehicles to our dealers	3.50	4.00
Information	Information helps us to build master production schedule (forecasts) and create delivery dates	4.58	5.00
	Information is used on actual demand to be transmitted quickly to reflect real demand accurately.	3.92	4.50
Supplier selection	We select suppliers based on low price/cost.	3.83	4.00
	We select suppliers on the basis of high quality standards.	4.42	4.50
	We select suppliers on the basis of dependability/sustainability.	3.75	3.50
	We select suppliers on the basis of flexibility.	3.42	3.50
Pricing strategy	Our pricing strategy is determined by balancing supply and demand.	3.42	3.50
	Our pricing strategy is based on low margins (low margins based on high volume).	2.58	3.00
	Our pricing strategy is based on differentiation in the market.	2.83	3.50

Following the results in Table 8:

- *Production.* The results indicated that manufacturers tended to implement excess capacity and flexible manufacturing (means of 2.92 and 2.91 respectively) to a moderate extent, which indicated a lean supply chain. An agile supply chain is characterized by excess capacity and flexibility.
- *Inventory.* The respondents indicated that they implemented the practice of working on a strict JIT system and keeping inventory holding in the production process to a minimum (a mean of 4.17). A strict JIT system is a characteristic of a lean supply chain strategy.
- *Location.* Respondents tended to use decentralized distribution centres (stores) to serve dealers to a moderate extent (a mean of 2.75). Local strategic suppliers tended to be located close to the production plant to a greater extent (a mean of 3.67). Decentralized distribution centres and strategic suppliers close to the manufacturers indicated a responsive (agile) supply chain strategy.
- *Transportation.* The results show that frequent shipments to strategic customers were done to a great extent (a mean of 4.25). Also, manufacturers tended to receive, on average, small and frequent shipments from their strategic suppliers (a mean value of 3.92). Moreover, the low cost mode of transportation for parts purchased from their strategic suppliers tended to be used to a great extent (mean of 3.83). Low cost modes of transportation of vehicles to dealers were used to a moderate extent (a mean of 3.50). This result shows that small, frequent shipments were made between supply chain partners (flexibility) a low cost transportation mode was used. Hence, characteristics of both lean and agile supply chain strategies were exhibited.

- *Information.* Forecasting information is used to build master production schedules and create delivery dates for the production line or model to a great extent (a mean of 4.58). However, demand was used to transmit and reflect real demand quickly and accurately to a great extent (a mean of 3.92). The use of forecasting information indicates a lean supply chain strategy, while quick transmission of information on orders indicates an agile supply chain strategy.
- *Supplier selection.* Quality was used as a criterion for selecting suppliers to a great extent (a mean of 4.42). Low price/cost was also used as a criterion (a mean of 3.83). Dependability/sustainability was used to a great extent (a mean of 3.75) and flexibility to a moderate extent (a mean of 3.42). The results show that supplier selection was based more on quality (which is a qualifier for both lean and agile supply chain) and cost which is a winner criterion for a lean supply chain strategy.
- *Pricing strategy.* A pricing strategy based on balancing supply chain demand tended to be implemented, to a moderate extent (mean of 3.4), based on low margins (low margins and high volume) to a moderate extent (a mean of 2.58) and differentiating products to a moderate extent (a mean of 2.83). The results show that 'balancing pricing and demand' was the most implemented practice, followed by pricing based on low margins. Therefore, based on the pricing characteristics, manufacturers seemed to lean towards a lean supply chain strategy.

The research objective of the article was stated as:

To investigate supply chain strategies employed by light vehicle manufacturers South Africa.

In order to answer the research objective, respondents were also asked to tick whether their strategy in the production line was a lean or agile supply chain for inbound and outbound directions. With reference to the inbound supply chain, all the respondents indicated that their strategy was based on efficiency (lean supply chain strategy). Table 9 indicates the responses of the respondents with reference to inbound supply chain.

Table 9. Responses regarding inbound supply chain strategy

Which of the following supply chain strategies for the product line are used for the inbound supply chain?	Percentage
Lean supply chain strategy (efficiency)	100.0%
Agile supply chain strategy (responsiveness)	0.0%

Regarding the outbound supply chain strategy for the production line, 66.7% of the respondents indicated that they followed a lean supply chain strategy, while 33.3% said they followed an agile supply chain strategy. Table 10 indicates the respondents' responses to the outbound supply chain strategy.

Table 10. Responses regarding outbound supply chain strategy

Which of the following supply chain strategies for the product line is used for the outbound supply chain?	Percentage
Lean supply chain strategy (efficiency)	66.7%
Agile supply chain strategy (responsiveness)	33.3%

From Tables 9 and 10 it is evident that a lean supply chain was the predominant supply chain strategy for light vehicle manufacturers of the models under investigation. However, few models employed an agile supply chain strategy in their outbound supply chain. The manufacturers, therefore, exhibited the leagile supply chain strategy and applied the practice of postponement (decision-making analysis); at this point, a lean supply chain in the inbound supply chain changes to an agile supply chain.

Conclusion

The results of this article revealed that the lean supply chain strategy is dominant among light vehicle manufacturers in South Africa. All light vehicle manufacturers employ a lean strategy for their inbound supply chain and a number of manufacturers had a lean supply chain strategy for their outbound supply chain. A number of the manufacturers also had an agile supply chain strategy in the outbound supply chain which suggests a leagile supply chain strategy. A mismatch between strategies and practices in the area of product characteristics, manufacturing characteristics and the decision drivers of the supply chain in some instances was also found. Mismatches are the root cause of the problems plaguing many supply chains and, therefore, supply chain strategies that are based on a one-size-fits-all strategy will fail. An effective supply chain strategy must be aligned with a company's business strategy, since a mismatch generally leads to significant problems in business operations. It is, therefore, imperative for South African supply chain managers to understand their customers' needs and to choose and implement the right strategy for the supply chain in order to satisfy customer demands. By implementing the optimal supply chain strategy, the South African automotive industry's competitive position would be improved. An organization can employ a lean (efficient), agile (responsive) or a combination of lean and agile supply chain strategy (leagile) which must be aligned with the business strategy.

Three important conclusions emerged from the study. *Firstly,* supply chain strategy is more than a product strategy. It involves many other considerations. The supply chain dynamics is important to understand

change in the supply chain strategy. Factors such as decision drivers (production, inventory, location, transportation, information, sourcing and pricing) have barely been discussed as determinants of a supply chain strategy. Information technology centralized and collaborative planning, and process integration are equally important determinants of an optimal supply chain strategy. *Secondly,* the article revealed that despite the emergence of agility, a lean supply chain strategy is still a force to be reckoned with. It is the dominant supply chain strategy in many organizations. *Thirdly,* light vehicle manufacturers do not always align their practices to the chosen strategy which results in a misalignment of supply chain strategy. *A limitation* of the article is that one of the light vehicle manufacturers of local models was unwilling to participate in the study (90%). It is not known if the findings would have been different if this company were involved. For further research, it is recommended that the study also be carried out for light vehicle manufacturers in other countries.

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