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## Strategies of light vehicle manufacturers in South Africa based on supply chain decision drivers

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**Abstract:** This article seeks to determine supply chain strategies of light vehicle manufacturers in South Africa based on the decision drivers. A descriptive research design was employed, based on a survey of light vehicle manufacturers. The results revealed that decision drivers such as production, inventory, location, information, transportation, sourcing, as well as pricing are vital in determining supply chain strategies. All of the light vehicle manufacturers employed lean supply chain strategy while few of the manufacturers employed agile supply chain strategy. There were mismatch between strategies and practices with regard to the decision drivers, and in some instances, the drivers were not always in line with the chosen supply chain strategy. It is therefore, imperative for South African supply chain managers to understand their customers' needs and implement the right decision drivers to ensure alignment with their chosen strategy for the supply chain in order to optimise competitive advantage.

**Keywords:** strategies; decision drivers; light vehicle manufacturers; supply chain; South Africa.

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### 1 Introduction

Strategies are pivotal to the success of most contemporary business organisations [Wu, (2008), p.3]. Supply chain strategies exist whether or not they are planned. In other words, all organisations have a *de facto* strategy. Cohen and Rousell (2005, p.10) asserted

that a supply chain strategy is part of the overall business strategy designed around a well-defined basis of competition (innovation, low cost, service and quality). Therefore, a good supply chain strategy must be aligned with a company's business strategy since a mismatch generally leads to significant problems in business operation [Lo and Power, (2010), p.140]. There are two generic and widely accepted supply chain strategies. These are 'lean' and 'agile' supply chain strategies (Fisher, 1997; Mason-Jones et al., 2000; Christopher and Towill, 2002; Vinodh et al., 2009). Identifying these types of supply chain strategies may be appropriate in different circumstances to position a product in an organisation's portfolio based on the supply and demand characteristics.

Ambe (2012, p.126) asserted that determining an optimal supply chain strategy requires a trade-off between key variables [Ambe and Badenhorst-Weiss, (2011), p.338]. According to the influential work of Fisher (1997), a company can choose a supply chain strategy based on the nature of their product and by matching the strategy to the unique characteristics of different products or markets. Lee (2002, p.106) asserts that a strategy can be chosen by determining supply and demand characteristics (evolving versus stable supply). Apart from product and supply characteristics, other important criteria for determining a supply chain strategy. Chopra and Meindl (2010, p.44) believe that a trade-off of the decision drivers between efficiency and responsiveness is required to determine a supply chain strategy [Qi et al., (2011), p.372]. The decision drivers are critical in the supply chain as they provide an understanding of how an organisation can improve its supply chain performance in terms of responsiveness and efficiency [Chopra and Meindl, (2010), p.63; Sayuti, (2011), p.288]. Therefore, there are several factors that can be considered when determining a supply chain strategy [Qi et al., (2009), p.667; Ambe and Badenhorst-Weiss, 2011]. Despite these factors, the majority of scholars have emphasised product characteristics when determining supply chain strategies [El-Tawy and Gallea, (2011), p.809].

It is worthwhile to note that while research into supply chain strategy is well articulated, there is limited empirical studies on the profound work of Chopra and Meindl (2013) on the decision drivers as determinants of supply chain strategies in developing economies especially in South Africa. Most of the studies on supply chain strategies are based in Western and highly developed countries [Qi et al., (2009), p.668]. While these studies have opened the debate and discussions on supply chain strategies, generating new insights, there remains a need to provide empirical evidence in developing economies such as South Africa.

In South Africa, the automotive industry is the premier with regards to SCM practices. The industry is also very important to the South African economy as it is the largest manufacturing sector in the country. According to the Automotive Export Manual [AIEC, (2017), p.6], the industry contributed 7.4% to the country's gross domestic product (GDP) in 2016. Export of automotive products in 2016 accounted for 171.1 billion Rands and represented 15.6% of total South African exports. South Africa currently exports vehicles to over 70 countries, such as Japan (around 29% of the value of total exports), Australia (20%), the UK (12%) and the US (11%). African export destinations include Algeria, Zimbabwe and Nigeria. Also, the industry comprises of seven multinational automotive companies that have mother companies in Asia (Japan), the USA and Europe. These companies have different approaches to supply chain practices, organisational structures and cultural diversities and management styles. In light to the background, it is imperative to investigate strategies of light vehicle

manufacturers based on the decision drivers to understand supply chain strategies or combinations of supply chain strategies employed by manufacturers. The main question that is posed in this article is:

- What is the supply chain strategy of manufacturers of light vehicles based on the decision drivers of supply chain management?
- What are the supply chain strategies of individual light vehicle manufacturers based on decision drivers of supply chain?

Given the importance of the automotive industry to South Africa, it is imperative for supply chain managers to understand how to choose and implement the right strategy for the supply chain to satisfy customer demands. The article makes a novel contribution to the debate on supply chain strategies and present an opportunity for researchers in the country understand the state of practice concerning supply chain strategy. Pertinent literature sources on supply chain strategies as well as drivers of supply chain are employed. Subsequently, empirical research is presented highlighting the research method used, results and discussions as well as the conclusions.

## **2 Review of supply chain strategies and decision drivers**

This section explores supply chain strategies as well as the decision drivers of supply chain.

### *2.1 Defining supply chain strategy*

Due to an awareness of the need to align processes with trading partners to achieve business outcomes, business competition has shifted from a traditional firm basis to a supply chain-wide basis [Hugo et al., (2004), p.22; Lo and Power, (2010), p.140]. A supply chain strategy is part of the overall business strategy, designed around a well-defined basis of competition (innovation, low cost, service and quality) [Hugo et al., (2004), p.22]. It is integrated with marketing strategy and with customers' needs, product strategy as well as power position. In a rapidly evolving global economy, no firm exist in a vacuum [Hugo et al., (2004), p.22]. Organisations are under pressure to optimise their resources to manufacture products better, cheaper and faster at lower costs. The rapid pace of innovation in domestic and global industries has been accompanied by an increase in product variety, sophistication and quality and a decrease in costs [Hines, (2006), p.33]. Two generic strategies in the supply chain are lean and agile supply chain.

#### *Lean supply chain*

'Lean' is a supply chain term defined as the "enhancement of value by the elimination of waste" (Womack and Jones, 2003). Taj (2008, p.219) noted that in a holistic perspective, the idea of 'lean supply' is adopted from the concept of 'lean production'. According to Hilletoft (2009, p.19), the term originated from a major automotive-industry study, the International Motor Vehicle Program (IMVP), during the period 1986–1990. According to Goldsby et al. (2006), leanness aims to eliminate the various forms of waste and include: defective products, overproduction, inventory, process waste, movement of

people, transportation of products and waiting by the employees. Lean supply chains are usually combined with lean manufacturing and adopt a 'zero inventory' approach (Christopher, 2000). A lean supply chain is mainly concerned with cost reduction by operating the basic processes at minimum waste. Lean philosophy is applicable when market demand is predictable and buyers' decisions are highly dependent on the lowest price criterion. Due to the fact that market demand is predictable, product supply is based on forecasts [Gattorna, (2006), p.138]. Customers in lean supply chains receive value through "low production costs and logistics achieved by using all available synergies and economies of scale" [Gattorna, (2006), p.138].

### *Agile supply chain*

Parallel developments in the areas of agility and SCM have led to the introduction of the concept of an agile supply chain [Iskanius, (2006), p.101; Ismail and Sharifi, (2006), p.432]. While agility is accepted widely as a winning strategy for growth, the idea of creating agile supply chains has become a logical step for companies [Ismail and Sharifi, (2006), p.432]. According to Ismail and Sharifi (2006, p.432), agility in a supply chain is the ability of the supply chain as a whole and its members to quickly align the network and its operations to dynamic and turbulent requirements of the customers. The main focus is on running businesses in network structures with an adequate level of agility to respond to changes (responsiveness), as well as to proactively anticipate changes and seek new emerging opportunities [Sharifi et al., (2006), p.1080]. With the increase in competition, the current economic meltdown as well as companies wooing the customer, an agile supply chain has emerged as the new mantra. Those who can meet customer demands are more successful. The lean and agile supply chain systems can co-exist in a total supply chain. The phenomenon is known as leagile supply chain.

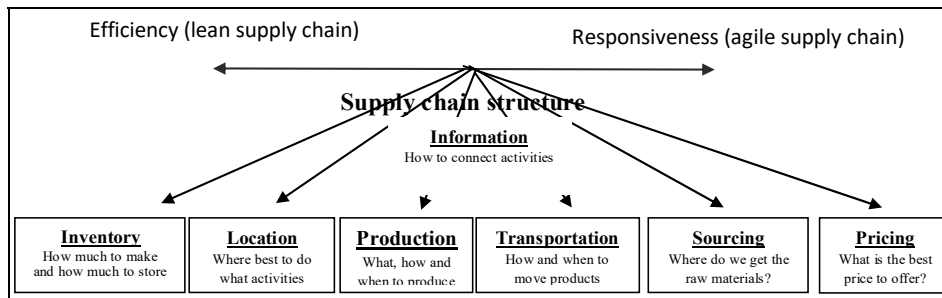
### *Leagile supply chain*

Numerous researches have shown that lean and agility approaches can be integrated in a variety of ways [Faisal et al., (2006), p.884; Krishnamurthy and Yauch, (2007), p.591; Hilletoft, (2009), p.20]. This is because they are common to each other; and can be linked to evolve a new manufacturing paradigm under the name leagile [Vinodh et al., (2009) p.573]. Krishnamurthy and Yauch (2007, p.591) define leagility as "a system in which the advantages of leanness and agility are combined". Leagile supply chain aims to infuse competitiveness in an organisation in a cost effective manner. Leagility is the combination of lean and agile paradigms within a total supply chain strategy by positioning the decoupling point so as to best suit the need for responding to a volatile demand downstream, yet providing level schedule upstream from the decoupling point [Hull, (2005), p.230; Vinodh et al., (2009), p.573; Rahiminia and Moghadasian, (2010), p.81]. The decoupling point is the point where order driven and the forecast driven activities meet. Therefore, lean supply chain is a requirement for building agile supply chain and agile supply chain is a strategy for responding to turbulent business environments. As denoted in the PRTM (2008) survey (2008–2010), "those who know how to setup, manage and rapidly configure their supply chains worldwide will outpace competitors in seizing market share".

2.2 Decision drivers as determinants of supply chain strategies

The Fisher (1997) model helped managers to understand the nature of their products and to devise a supply chain strategy that can best satisfy the specific demand [Jacobs et al., (2009), p.362]. According to Fisher’s (1997) model, a supply chain strategy is established based on the product type (functional or innovative products). Lee (2002, p.106) introduced a framework for establishing a strategy based on supply and demand uncertainties. According to Lee (2002, p.107), efficient and responsive supply chain strategies are associated with stable supply processes while risk-hedging and agile supply chains are associated with conditions of evolving supply processes. Chopra and Meindl (2010, p.44) consider two main strategies for the supply chain (efficiency and responsiveness) and introduce a three-step procedure for achieving strategic fit. Furthermore, Christopher and Towill (2002, p.8) contend that there are different pipelines to satisfy customer demands, but these pipelines must be selected to match the business strategy of the supply chain. As denoted by Chopra and Meindl (2010, p.63) and Sayuti (2011, p.288), decision drivers of supply chains could also be used as determinants of supply chain strategies. Each supply chain has its own unique set of market demands and operating challenges. Effective supply chain management calls first for an understanding of each driver and how it operates, which directly affect the supply chain decisions. The decision drivers examined in the article include: production (facilities), inventory, location, transportation, information, sourcing, pricing [Chopra and Meindl, (2016), p.58]. The supply chain strategy determines how the supply chain should be perform with respect to efficiency (lean supply chain) and responsiveness (agile supply chain). The supply chain must then use the drivers to reach performance level the supply chain strategy dictates and maximises supply chain profits. Figure 1 indicates the six supply chain drivers which could be change to dictate the supply chain structure of an organisation as well as the competitive strategy.

Figure 1 Framework for structuring supply chain strategies and decision drivers



Source: Adapted from Hugos (2011, p.6); Chopra and Meindl (2016, p.58)

The overall decisions made by an organisation concerning each driver will determine how well the supply chain serves its market and how profitable it is for the participants in the supply chain. The decision drivers and the trade-off for efficiency and responsiveness in different circumstances are briefly discussed below.

### *Production*

Production refers to the capacity of a supply chain system to make and store products. The facilities of production are factories and warehouses [Taylor, (2004), p.21]. The fundamental decision that managers face when making production decisions is how to resolve the trade-off between responsiveness and efficiency. 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. Facilities where all or almost all capacity is being used are not capable of responding easily to fluctuations in demand. However, capacity costs money and excess capacity is idle capacity not in use and not generating revenue. Hence, the more excess capacity there is, the less efficient the operation becomes [Hugos, (2006), p.10]. Factories can be built to accommodate one of two approaches to manufacturing, these being product focus and a functional focus. A factory that takes a product focus performs a range of different operations required to make a given product line from the fabrication of different product parts to assembly of these parts. The production process can be made extremely responsive by building factories that have a great deal of excess capacity and that use flexible manufacturing techniques to produce a wide range of items. To be even more 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, then a company can build factories with little excess capacity and have the factories optimised for producing a limited range of items. Further efficiency can be gained by centralising production in large central plants to obtain better economies of scale [Chopra and Meindl, (2010), p.62].

### *Inventory*

Production facilities contain controlled quantities of materials called inventories [Taylor, (2004), p.22]. Inventory is spread throughout the supply chain and includes everything from raw material to work in process and finished goods that are held by manufacturers, distributors and retailers in a supply chain. Managers must decide where they want to position themselves in the trade-off between responsiveness and efficiency [Nel and 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 demands [Bowersox et al., (2010), p.157]. However, the creation and storage of inventory is 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. Additional responsiveness can be gained by stocking products at many locations in order to have the inventory close to customers and available to them immediately. Efficiency in inventory management calls for reducing the inventory levels of all items and especially of items that do not sell as frequently. Also, economies of scale and cost savings can be obtained by keeping products in a few central locations only [Chopra and Meindl, (2010), p.65].

### *Location*

Location refers to the geographical placement of supply chain facilities [Jonsson, (2008), p.53]. It also includes decisions relating to which activities should be performed in each facility. The responsiveness versus efficiency trade-off here is the decision whether to

centralise activities in fewer locations to gain economies of scale and efficiency or to decentralise activities in many locations close to customers and suppliers in order for operations to be more responsive. 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 labour, 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]. Location decisions have a strong impact on the cost and performance characteristics of a supply chain. Once the size, number and location of facilities are determined, this also defines the number of possible paths through which products can flow on the way to the final customer. Location decisions reflect a company's basic strategy for building and delivering its products to the market. A location approach that emphasises responsiveness would be one where a company opens up many locations to be physically close to its customer base. Efficiency can be achieved by operating from only a few locations and centralising activities in common locations [Chopra and Meindl, (2010), p.63].

### *Transportation*

This refers to the movement of everything from raw material to finished goods between different facilities in a supply chain [Jonsson, (2008), p.63]. In transportation, 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, decisions made here are crucial. There are six basic modes of transport that a company can choose from. These include ship, rail, pipelines, trucks, airplanes and electronic transport [Jonsson, (2008), p.64]. According to Chopra and Meindl (2010, p.65), responsiveness can be achieved through 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. Efficiency can be emphasised by transporting products in larger batches and doing it less often. The use of transportation modes such as ship, rail and pipelines can be most efficient. Transportation can be made more efficient if it is originated out of a central hub facility instead of from many branch locations [Nel and Badenhorst-Weiss, (2010), p.211].

### *Information*

Information is the basis upon which to make decisions about the other four supply chain drivers. 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 (i.e., the data are accurate, timely and complete), the companies in a supply chain will each be able to make sound decisions for their own operations [Jonsson, (2008), p.90]. This will also tend to maximise the profitability of the supply chain as a whole. That is the way that stock markets or other free markets work and supply chains, have many of the same dynamics as markets. 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. Information,

much like money, is a useful commodity because it can be applied directly to enhance the performance of the other four supply chain drivers. 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*

Sourcing is the set of business processes required to purchase goods and services [Hines, (2006), p.177]. Managers must first decide which tasks will be outsourced and which will be performed inside the firm. For each task, the manager must decide whether to source from a single supplier or a portfolio of suppliers. If a portfolio of multiple suppliers is to be used, then the role of each supplier in the portfolio must be clarified. The next step is to identify the set of criteria that will be used to select suppliers and measure their performance [Jonsson, (2008), p.164]. Managers then select suppliers and negotiate contracts with them [Chopra and Meindl, (2010), p.72]. Sourcing decisions are 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]. However, responsiveness can be increased by gaining state-of-the-art products. Outsourcing decisions should be driven by the desire for growth in total supply chain surplus [Chopra and Meindl, (2010), p.73].

**Table 1** The impact of decision drivers on supply chain strategies

<i>Decision drivers</i>	<i>Efficiency (lean supply chain)</i>	<i>Responsiveness (agile supply chain)</i>
Production	<ul style="list-style-type: none"> <li>• Little excess capacity</li> <li>• Narrow focus</li> <li>• Few central plants</li> </ul>	<ul style="list-style-type: none"> <li>• Excess capacity</li> <li>• Flexible manufacturing</li> <li>• Many small factories</li> </ul>
Inventory	<ul style="list-style-type: none"> <li>• Low inventory levels</li> <li>• Fewer items</li> </ul>	<ul style="list-style-type: none"> <li>• High inventory levels</li> <li>• Wide range of items</li> </ul>
Location	<ul style="list-style-type: none"> <li>• Few central locations serve wide areas</li> </ul>	<ul style="list-style-type: none"> <li>• Many locations close to customers</li> </ul>
Transportation	<ul style="list-style-type: none"> <li>• Shipments few, large</li> <li>• Slow, cheaper modes</li> </ul>	<ul style="list-style-type: none"> <li>• Frequent shipments</li> <li>• Fast and flexible mode</li> </ul>
Information	<ul style="list-style-type: none"> <li>• Information is used to build master production schedule (forecasts) and creates delivery due dates</li> <li>• Cost of information decreases while other costs rise</li> </ul>	<ul style="list-style-type: none"> <li>• Information is used on actual demand to be transmitted quickly to reflect real demand accuracy</li> <li>• Collect and share timely, accurate data</li> </ul>
Sourcing	<ul style="list-style-type: none"> <li>• Supplier selection criteria based on low prices</li> </ul>	<ul style="list-style-type: none"> <li>• Supplier selection criteria based on high service levels</li> </ul>
Pricing	<ul style="list-style-type: none"> <li>• Pricing is a key means for balancing supply and demand</li> <li>• Based on low margins and high volumes</li> </ul>	<ul style="list-style-type: none"> <li>• Pricing does not normally impact on short-term demand</li> <li>• Based on high margins</li> </ul>

Source: Researcher’s own construction



### *Pricing*

Pricing is the process whereby a firm decides how much to charge customers for its goods and services. 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 as well as 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 behaviour 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 1 summarises the impact of decision drivers on supply chain strategies.

## **3 Research methodology**

This section presents the research methodology employed in the study. To find a solution to the research objective, the study was exploratory and descriptive in nature. A descriptive research design was employed among light vehicle manufacturers based on a survey of vehicle manufacturers in South Africa. The target population was all seven light vehicle manufacturers in South Africa. South Africa has seven 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 categorised into light commercial, medium commercial and heavy commercial. Passenger vehicles 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). The study focused on one production line (models) for each of the manufacturers. The population therefore, constituted 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 2 presents the various models of passenger and light commercial vehicles assembled in South Africa.

The study 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, the USA 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 on 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.

**Table 2** Light vehicle manufacturers and locally manufactured models in South Africa, 2011

<i>Passenger vehicles (2011)</i>		<i>Light commercial (2011)</i>	
<i>Manufacturer</i>	<i>Models</i>	<i>Manufacturers</i>	<i>Models</i>
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 (2012)

Primary data were collected through face-to-face interview questionnaires. The interview questionnaire was measured using a Likert scale format type with (1) 'strongly disagree' and (5) 'strongly agree' end points. A total of 24 in-depth interviews were conducted. Each questionnaire was completed for a particular vehicle (model). A total of six models/productions 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 analysed and presented descriptively using statistical package for social sciences (SPSS).

#### 4 Results and discussions

The results and discussions begin with supply chain strategies of the light vehicle manufacturers in general and thereafter the specific light vehicle manufacturers are discussed.

##### 4.1 Determining supply chain strategies 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. A five-point Likert response format with end points 1 (no extent) to 5 (very great extent) was used and the mean and median results are presented in Table 3.

- *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 characterised by excess capacity and flexibility.
- *Inventory*: With regard to 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 to a great extent (a mean of 4.17). A strict JIT system is a characteristic of a lean supply chain strategy.

- *Location:* Respondents tended to use decentralised 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). Decentralised distribution centres and strategic suppliers close to the manufacturers indicate 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, on average, to a moderate extent (a mean of 3.50). This result shows that small and frequent shipments were made between supply chain partners (flexibility) as well as the employment of a low cost transportation mode. 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 very great extent (a mean of 4.58). However, demand was used to quickly transmit and reflect real demand 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). This result shows 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:* 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.

Following the discussion above, decision drivers are vital for determining supply chain strategies. Based on the characteristics examined, production, inventory, supplier selection, pricing followed a lean supply chain while location, transportation and information exhibited characteristics of lean and agile supply chain (leagile supply chain). The results show that both lean and agile supply chain are implemented in the South African automotive industry. However, how these drivers are implemented determines whether the supply chain employs a lean supply chain or an agile supply chain or a combination of the two (leagile supply chain).

**Table 3** Responses regarding decision drivers of the supply chain

	<i>Statements</i>	<i>Mean</i>	<i>Median</i>
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 decentralised distribution centres (stores) to serve our dealers.	2.75	2.00
	Our local strategic suppliers are located close to our production plan.	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 purchased 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 schedules (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

#### 4.2 Responses regarding decision drivers of supply chain by manufacturers

The decision drivers of SCM were also analysed to understand how the different manufacturers used them. Mean level of agreement scores were used to present the results. The results are discussed in the same manner as in section 7.3.7 (production, inventory, location, transportation, information, supplier selection and pricing strategy). Table 4 presents the responses of the different manufacturers on decision drivers of supply chain. For the purpose of analysis, the following abbreviations were used: E1 for European manufacturer 1, E2 for European manufacturer 2, E3 for European manufacturer 3, AM for US manufacturer, A1 for Asian manufacturer 1 and A2 for Asian manufacturer 2.

**Table 4** Responses regarding decision drivers of the supply chain by manufacturers

<i>Statements</i>	<i>Mean level of agreement</i>					
	<i>E1</i>	<i>AM</i>	<i>E2</i>	<i>A1</i>	<i>A2</i>	<i>E3</i>
<i>Production</i>						
We have excess capacity in our production process.	3.00	4.50	2.00	3.00	1.00	2.50
We have flexible manufacturing processes.	2.00	3.50	4.00	2.75	2.00	3.00
<i>Inventory</i>						
We work on a strict JIT system and therefore keep inventory holding in the production process to a minimum.	4.50	4.50	5.00	3.50	5.00	4.00
<i>Location</i>						
We have decentralised distribution centres (stores) to serve our dealers.	3.00	4.50	2.00	2.25	1.00	3.00
Our local strategic suppliers are located close to our production plant.	5.00	2.50	5.00	3.00	3.00	4.50
<i>Transportation</i>						
We make small and frequent shipments to our strategic customers.	3.50	4.50	5.00	4.25	5.00	4.00
We receive small and frequent shipments from our strategic suppliers.	4.00	4.00	4.00	3.50	5.00	4.00
We make use of the lowest acceptable mode of transportation for parts purchased from our strategic suppliers.	4.50	4.50	3.00	3.75	3.00	3.50
We make use of the lowest acceptable mode of transportation for vehicles to our dealers.	4.00	4.50	1.00	3.00	4.00	4.00
<i>Information</i>						
Information helps us to build master production schedules (forecasts) and create delivery dates.	5.00	4.50	5.00	4.25	5.00	4.50
Information is used on actual demand to be transmitted quickly to reflect real demand accurately.	5.00	3.00	5.00	3.75	2.00	4.50
<i>Supplier selection</i>						
We select suppliers on the basis of low price/cost.	3.00	4.00	3.00	4.25	3.00	4.50
We select suppliers on the basis of high- quality standards.	5.00	4.00	5.00	3.00	5.00	4.50
We select suppliers on the basis of dependability/sustainability.	4.50	3.00	5.00	2.50	5.00	3.50
We select suppliers on the basis of flexibility.	4.50	4.00	4.00	3.25	4.00	3.00
<i>Pricing strategy</i>						
Our pricing strategy is determined by balancing supply and demand.	4.50	2.00	5.00	2.50	3.00	3.50
Our pricing strategy is based on low margins (low margins based on high volume).	4.00	1.00	3.00	3.25	2.00	3.00
Our pricing strategy is based on differentiation in the market.	3.50	1.00	4.00	4.00	1.00	4.00

- *Production:* The US manufacturer had excess capacity in its production process to a very great extent (a mean of 4.50), while Asian manufacturer 2 had no excess capacity (a mean of 1.00). Flexible manufacturing was practised to a great extent by European manufacturer 2 (a mean of 4.00) and by the US manufacturer (a mean of 3.9), while European manufacturer 1 and Asian manufacturer 2 implemented the practice only to a slight extent (a mean of 2.00). This means that the US manufacturer seemed to lean towards an agile supply chain strategy, while Asian manufacturer 2 was inclined towards a lean supply chain.
- *Inventory:* European manufacturer 2 and Asian manufacturer 2 worked on a strict JIT system to a great and very great extent (means of 4.00 to 5.00) and Asian manufacturer 1 tended to implement the practice to a great extent (a mean of 3.50). This result is in line with the previous findings, where all the respondents (100%) indicated a lean supply chain strategy.
- *Location:* The US manufacturer used decentralised distribution centres (stores) to serve dealers to a very great extent (a mean of 4.50) and European manufacturers 1 and 3 to some extent (a mean of 3.00), while Asian manufacturer 1 mainly used centralised distribution systems (a mean of 1.00). European manufacturers 1, 2 and 3 had local strategic suppliers located close to the production plant to a very great extent (means of 4.50 to 5.00). European manufacturers 1 and 2 had their strategic suppliers close to the manufacturing plant to a very great extent (a mean of 5.00). Decentralised distribution and close suppliers are indicative of an agile supply chain strategy.
- *Transportation:* All the manufacturers, on average, made small and frequent shipments to their strategic customers and suppliers to a great or very great extent (means of 3.5 to 5.00). The result also indicates that European manufacturer 1 and the US manufacturer made use of low-cost transportation modes for parts purchased from strategic suppliers to a very great extent (a mean of 4.50). European manufacturers 1 and 3, the US manufacturer and Asian manufacturer 2 made use of the lowest acceptable mode of transportation for distributing vehicles to dealers, on average, to a great extent (means of 4.00 to 4.50), while European manufacturer 2 did not implement the practice at all (a mean of 1.00). This means that most of the manufacturers used low-cost and efficient means of transportation, which is a characteristic of a lean supply chain, while European manufacturer 2 used a flexible mode of transportation which is a characteristic of an agile supply chain.
- *Information:* All the manufacturers used forecasting information to build master production schedules and create delivery dates, on average, to a very great extent (a mean of 4.25 to 5.00). European manufacturers 1, 2 and 3 used information on actual demand that is transmitted quickly to accurately reflect real demand, on average, from a great extent to a very great extent (means of 4.00 to 5.00), while Asian manufacturer 2 implemented the practice to a slight extent (a mean of 2.00). Using forecasting information is indicative of a lean supply chain, while actual demand information indicates an agile supply chain. European manufacturers 1, 2 and 3 demonstrated both methods, which is indicative of a lean and agile (leagile) supply chain strategy.

- *Supplier selection*: The US manufacturer, Asian manufacturer 1 and European manufacturer 3 used low price as a criterion to select their suppliers to a great extent (means of 4.00 to 4.50), while European manufacturers 1 and 2 and Asian manufacturer 2 used this criterion to a moderate extent (a mean of 3.00). All the manufacturers except Asian manufacturer 1, used high-quality standards to select suppliers, on average, from a great extent to a very great extent (means of 4.00 to 5.00). European manufacturers 1 and 2 selected suppliers on the basis of dependability and sustainability to a very great extent (means of 4.50 to 5.00). Four of the manufacturers (European manufacturers 1 and 2, Asian manufacturer 2 and the US manufacturer) used flexibility as the criterion to a great extent to select their suppliers (means of 4.00 to 4.50). Low cost as a criterion indicates a lean supply chain, while flexibility indicates an agile supply chain strategy.
- *Pricing strategy*: European manufacturers 1 and 2 used pricing strategy based on balancing supply and demand to a very great extent (mean values of 4.50 and 5.00 respectively). With regard to pricing strategy based on low margins, European manufacturer 1 recorded the highest mean value of 4.00 indicating a great extent, while the US manufacturer did not implement the strategy at all (a mean of 1.00). European manufacturers 1, 2 and 3 and Asian manufacturer 1 used differentiation to a great extent (means of 3.50 to 4.00). The US manufacturer and Asian manufacturer 2 did not use differentiation as a pricing strategy (a mean of 1.00). Balancing supply and demand and a low margin are typical pricing strategies of a lean supply chain and this was used by European manufacturers 1, 2 and 3. Differentiation is a typical pricing strategy for an agile supply chain and this was used by European manufacturers 1, 2 and 3 and Asian manufacturer 1.

**Table 5** Aligning decision drivers to supply chain strategies

<i>Drivers</i>	<i>Lean supply chain</i>	<i>Agile supply chain</i>
Production	Little excess capacity ( <i>E2 and E3, A2</i> )	Excess capacity ( <i>E1, AM and A1</i> )
Inventory	Work on a strict JIT system ( <i>E1, E2 and E3, AM, A1 and A2</i> )	
Location	Centralised distribution centres ( <i>A1 and 2, E2</i> )	Decentralised distribution centres ( <i>E1 and E3, AM</i> )
Transportation	Low-cost mode of transport to dealers ( <i>E1 and E3, AM, A1 and A2</i> )	Fast and flexible shipments to dealers ( <i>E2</i> )
Source of information	Builds master production schedule and creates fixed delivery dates ( <i>E1, E2 and E3, AM, A1 and A2</i> )	Transmits actual demand to reflect accurate demand ( <i>E1, E2 and E3</i> )
Supplier selection	Based on quality, cost ( <i>E1, E2 and E3, AM, A1 and A2</i> )	Based on quality, flexibility ( <i>E1, E2 and E3, AM, A1 and A2</i> )
Pricing	Based on low margins ( <i>E1, E2 and E3, A1</i> )	Based on differentiation ( <i>AM and A2</i> )

Following the discussions regarding Table 4, the results reveal that both lean and agile supply chain practices are evident in the South African automotive industry. Table 5 represents an alignment of the decision drivers and supply chain strategies by the manufacturers. For the purpose of analysis, the following abbreviations were used: E1 for European manufacturer 1, E2 for European manufacturer 2, E3 for European

manufacturer 3, AM for US manufacturer, A1 for Asian manufacturer 1 and A2 for Asian manufacturer 2.

Table 4 shows some degree of mismatch between the drivers of supply chain and supply chain strategies among the vehicles. In both the portfolio matrixes, Asian manufacturer 1, for example, was placed as a lean supply chain, but in Table 4, it has an excess capacity in the production process, which is in fact an agile supply chain characteristic. European manufacturer 3 was a mismatch in the product matrix, manufacturing matrix and also in the decision drivers. This means they are trying to be both lean and agile without executing the trade-off practices of lean and agile supply chain. All manufacturers (European manufacturers 1, 2 and 3, US manufacturer, Asian manufacturers 1 and 2) utilised quality, cost and flexibility criteria for selecting suppliers, which involve both lean (cost) and agile (flexibility) characteristics. In conclusion, some practices employed by the local manufacturers are inconsistent with their strategies.

## **5 Conclusions**

This article determines supply chain strategies of light vehicle manufacturers in South Africa based on the decision drivers of supply chain management. The research method employed was a survey of light vehicle manufacturers in South Africa. From the findings, it is evident that decision drivers of supply chain could be used to determine supply chain strategies. The study revealed, however, that the decision drivers were not always in line with the chosen supply chain strategies. Decision drivers discussed in the article were production (facilities), inventory, location, transportation, information, supplier selection and pricing. How these drivers are implemented determines whether the supply chain employs a lean supply chain or an agile supply chain or a combination of the two (leagile supply chain). The results across the industry show that excess capacity exists and flexible manufacturing processes are implemented by the light vehicle manufacturers. Working on a strict JIT system and keeping inventory holding in the production process to a minimum are implemented to a great extent, indicating a lean supply chain. These findings are consistent with a lean supply chain practice as reflected in the findings of Sebastiao and Golicic (2008).

With regards to the individual vehicle manufacturers, the results also revealed that both lean and agile supply chain practices are evident in the South African automotive industry. However, while some of the manufacturers used drivers according to the strategy, others wrongly applied the drivers. Hence, a mismatch between strategies and practices with regards to 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 making optimal decision about the drivers of supply chains, light vehicle manufacturers in South Africa can strategically position themselves for competitive advantage and for continuous improvement. An organisation



can employ a lean (efficient), agile (responsive) or a combination of lean and agile supply chain strategy (leagile) which must be aligned with the decision drivers.

The findings of this article contribute to the body of knowledge of supply chain strategies and in particular South African researchers and managers. Given the importance of the automotive industry to South Africa, it is imperative for supply chain managers to understand how to choose and implement the right strategy for the supply chain to satisfy customer demands. For supply chain researchers, it presents a novel contribution to the debate on supply chain strategies and an opportunity to understand the state of practice concerning supply chain strategy. For supply chain managers, it gives a strategic direction on how to implement supply chain decision drivers based on the organisational strategy.

Three important conclusions emerged from the study. Firstly, supply chain strategy is more than a product strategy. There are other considerations in determining supply chain strategies. Decision drivers such as production, inventory, location, transportation, information, sourcing and pricing have barely been discussed as determinants of a 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 organisations. Thirdly, light vehicle manufacturers do not always align their decision drivers to the chosen strategy which results in a misalignment of supply chain strategy.

A limitation of the study 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 was 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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