DOI 10.17605/OSF.IO/ZRY42
ORCID 0009-0008-6625-9337

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EXECUTIVE SUMMARY

This paper explores the topic of supply chain management using case studies of companies from the automotive industry. Focus is given to the manner in which supply chain strategies in the automotive industry are designed and implemented, and how automotive companies configure their supply chains through collaboration, lean principles and agility. The paper also explores how advanced technologies, notably Big Data analytics and the Internet of Things, are utilised in the automotive industry to maintain a competitive advantage. Key findings made in the discussion are that success in supply chain management is greatly enhanced if firms seek to integrate the different components making up the supply chain.

Additionally, the collaboration between entities fosters trust, which is a vital ingredient in the application of lean principles. The automotive industry shows that companies should pursue flexibility and efficiency, which are captured in the notions of agility and leanness, respectively. The paper identifies collaboration and advanced technologies as two critical sources of sustainable competitive advantages to organisations primarily in reference to supply chain management.

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Global Supply Chain Management

The concept of supply chains has gained increasing popularity in the contemporary business world. It is universally acknowledged that supply chains have a significant impact on profitability in organisations. According to Coyle et al. (**2012, p.160**), "the more efficient and productive the supply chain, the greater is the profit potential of the organisation". This is to say that organisations with effective supply chains are more efficient and enjoy higher profits.

Nonetheless, it must be kept in mind that firms operate in an environment that is defined or influenced by constant changes. Factors such as technological developments, changing economic cycles, legal requirements and sociocultural factors all necessitate regular adjustments or review of supply chain strategies for companies to remain competitive and profitable. A modern supply chain is a dynamic network of high complexity. Thus, organisations should devote significant resources to developing supply chain strategies, configuring supply chains to maximise performance and coping with technological changes. To understand what this means, the automotive industry is used in this paper. Specific topics that are tackled are the design and implementation of supply chain strategies in the industry, how automotive companies configure their supply chains through collaboration, lean principles and agility, and how the companies make use of advanced technology such as the Internet of Things and big data analytics to maintain a competitive advantage

Definition

Even though supply chain management-SCM- is a popular concept in today's business organisation, it is still deemed necessary to provide a working definition of the term. SCM is entirely about managing supply chain activities, which are the activities that are associated with "the flow and transformation of goods from the raw materials stage, through to the end-user, as well as the associated information flows" (**Dam & Skjott-Larsen, 2005 p.11**). Such activities include business process and organisational relationships that are necessary for the creation of high-performing systems that confer a sustainable competitive edge to firms.

Supply chain management, therefore, refers to "the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole" (**Dam & Skjott-Larsen, 2005 p.11**). This definition indicates that supply chain strategies ought to focus on building and to sustain healthy relationships between organisations and their customers, suppliers, and any other stakeholder who plays a part in the achievement of the organisation's objectives.

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Design and Implementation of Supply Chain Strategies in the Automotive Industry

Automotive companies are confronted by a number of challenges that relate to the supply chain. For example, concerns about pollution have put pressure on automotive firms to take necessary measures towards reducing carbon emissions resulting from operations. Apart from this, it is necessary that such firms devise appropriate strategies for boosting efficiency. According to **DHL** (**2015, p.4**), the cost of an assembly plant can go to as high as 0.5 billion euros. Consequently, manufacturers are compelled to put in place necessary strategies and measures that will help them reap the maximum gains from their investments. At the same time, the demand for the responsiveness of supply chains has necessitated the development of "just in time" systems.

Globalisation and growth of emerging markets

Countries such as China are rapidly ascending to become some among the world's principal markets. This, coupled with the globalisation wave, has created both opportunities and threats for the automotive industry. Precisely, transport infrastructures have been rendered inadequate, making it necessary for automotive companies to design and build assembly plants in the emerging markets while also integrating them within the global networks of production (**DHL, 2015 p.4**). In addition, globalisation means that companies have the choice to source vital components or raw materials from distant places as long as this is established to be cost-effective. As such, it becomes critical for firms to devise strategies of managing the shipment of these components from their source destinations to the final destination. The challenge here is that companies must adequately address issues such as customs clearance as well as cross-border transport regulations and demands. There is also the issue of talent; according to **DHL** (**2015, p.4**), one of the secrets to success in supply chain management is locating the right people for the job. Since every organisation is on the look-out for skilled and experienced personnel, finding and retaining the best talent can prove challenging. In other words, to effectively manage a supply chain that captures or responds to changing demands in the market demands that companies hire and retain high-quality employees who possess the right experience together with technical knowledge.

To understand how supply chain strategies in the automotive industry are designed and implemented, it is worth noting that the supply chain in the automotive sector is highly complex, comprising numerous process that links together "to form a supply chain from the customer back to the various tiers of suppliers" (**Iyer, 2009 p.5**). In short, the supply chain in the automotive sector comprises physical processes as well as operational

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and pre-production processes. Physical processes include parts production, transportation to assembly plant, assembly into completed vehicles, distribution to dealers, and delivery to customers.

An critical deduction that can be made from the description of the processes that make up the supply chain in the automotive industry is that for strategies to be effective, there is need for firms to aim at integrating suppliers and customers while also ensuring coordination across the various value-adding processes (**Tayur & Ganeshan, 1991 p.671**). Supporting this view, Flynn, **Morita and Machuca** (**2010, p.16**) observes that "supplier integration has become an important concept for improving supply chain performance in networked industries such as the automotive industry". For this reason, firms design their supply chain strategies in such a way that there is seamless congruence between the supplier's functions and the company's internal work processes. This way, the process capabilities of the supplier are jointly shared with the design specifications of the buyer. The end result of this kind of integration is that the time taken to develop a new product is significantly shortened.

Integration in the supply chain is illustrated by the Toyota Company, which follows a process it refers to as Production-Sale Integration. Here, the company has developed a computer system that links itself with its suppliers, dealers, body makers and customers (**Hino, 20052 p.167**). In so doing, the company ensures that different components of the supply chain work together and share vital information, and this has generated benefits to all parties, notably customers, suppliers and manufacturers (**Magretta, 2012 p.129**).

Agility, Lean Principles, and Collaboration

From the preceding discussion, it is evident that supply chains function best if they are approached, designed and implanted "as an integrated whole rather than as a collection of separate processes" (**Harrison, Lee & Neale, 2003 p.63**). In line with this, it is crucial that firms seek to collaborate with all components of the supply chain.

Owing to the complexity of supply chain networks, the concept of agility has gained widespread popularity in SCM. According to **Wang and Koh** (**2010, p.39**), an agile supply chain refers to one in which information, decisions and materials flow fast across the entire supply network. The authors add that this is only possible via close collaboration as well as the integration of the firm's external and internal supply chains. Agility is defined as the capability of achieving rapid response to markets that are continually changing (**Basu, 2012,**

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p.116). It embraces information systems, mindsets, organisational structures and logistics processes and places emphasis on effectiveness together with the flexibility (**Gattorna, Ogulin & Reynolds, 2016 p.284**).

Since agility is concerned with flexibility, companies strive to maintain suppleness by postponing standard platforms such that a company will only embark on the assembling of components and products when customer demand is known. In so doing, companies minimise the loss of having excess stock, holding minimum stock of finished goods while simultaneously making it possible to manufacture and deliver customised products when customers demand such (**Basu, 2012 p.116**). In short, agility helps companies to avoid losses that arise from fluctuations in demand.

When talking about supply chain management, the concept of lean principles is very popular. Mention of the term 'lean principles' brings into mind the Toyota Company that is famous for its lean management practices, which have been pivotal to the automotive company's spectacular success over the years. The principle of lean management fundamentally refers to the tools that are utilised in the elimination of waste while also enhancing perfection via continuous improvement. In the context of SCM, lean thinking refers to "the use of lean principles to align activities across corporate functions within the firm and to manage business relationships with customers and suppliers" (**Lambert, 2008 p.217**). This suggests that lean principles go hand in hand with collaboration.

Lean principles emphasise on the use of as minimal resources as possible to achieve the maximum possible results. In the Toyota Company, the principle of lean thinking means the use of less space, equipment and material to generate a maximum output of high quality within the shortest time possible (**Lambert, 2008 p.217**). Lean principles are used to configure the supply chain based on the fact that there are some activities that consume a significant quantity of resources without generating value to customers. Examples include unnecessary transportation, excessive inventory, long waiting tines, defective products and unnecessary movement (**Lambert, 2008 p.217**).

At the Toyota Company, lean thinking demands that value be specified from the viewpoint of the customer and that the company strives towards perfection. As such, the company's management designs the supply chain in such a way that operational interfaces between the company and customers, together with key suppliers, are actively managed so that end-customers' needs are met. In other words, lean thinking is applied in Toyota's supply chain via an "integrated approach to materials management…where the flows of materials and information are coordinated across primary members of the supply chain" (**Lambert, 2008 p.217**). In doing so, the company is in a position to eliminate unnecessary waste.

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It is difficult to effectively apply lean principles in configuring the supply chain unless there is a collaboration between a company and its suppliers as well as customers and all other entities that make up the supply chain. The benefits that are derived from lean principles or lean thinking are only realised when the different parties making up the supply chain are involved. In the words of **Lambert (2008, p.220)**, "the greatest value will be created when the discussions about improvement opportunities are open, honest, and encouraged". Using the Toyota Company as an excellent illustration of what lean thinking entails, Schniederjans, Schniederjans and **Cao (2018, p.191)** highlight trust as the basis upon which lean thinking can be developed and applied in supply chain management. An important observation made by the author's trust can only exist between companies, employees, suppliers and customers when collaboration is fostered. To be more specific, elimination of waste through proper production scheduling calls for "a close relationship with suppliers, [which is] achieved in part by allocating most of a firm's business to one or just a few suppliers that can be trusted to perform deliveries without failure" (**Schniederjans et al., 2018 p.191**). Again, this narrows down to the concept of lean, which is about striving to deliver maximum output using the least possible resources and effort.

For collaboration to be established and maintained between organisations and their supply chain partners or components, several points have to be factored in. To begin with, it is essential that firms identify and take note of the needs of the various stakeholders right at the start of the supply chain relationship. Secondly, organisations must come up with clear objectives together with metrics against which success will be measured. It is also vital to develop a product as well as a program that will guide success.

The value derived from collaboration as a critical strategy in supply chain management is further illustrated by the report that there are times when firms competing in the same industry come together to devise appropriate mechanisms of responding to the challenges posed by today's complex business environment. According to **Dessler and Phillips (n.d., p.499)**, DaimlerChrysler, Ford, and General Motors have collaborated to create "a joint purchasing website where suppliers come to match their products to America's big three auto companies' needs". This statement clearly illustrates the importance of collaboration as a critical ingredient in effective supply chain management.

Use of Advanced Technology to Maintain Competitive Advantage

Collaboration between firms and the entities that make up their supply chains has been identified as one of the sources of competitive advantage, especially in the automotive sector. Besides collaboration, technology is another source of competitive advantage even though there is the view that due to its ease of replication,

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"technology can never be a source of competitive advantage" (**Dubey, 2017 p.65**). The rationale behind this latter claim is that everyone can access technology, meaning that firms can quickly adapt or emulate the technologies that their rivals are using to stay ahead in the market.

While there is some element of the element in the above counter-argument, it is equally valid that new technologies are being invented and rolled out on an almost daily basis. Moreover, the extremely competitive business world of today demands that manufacturers utilise advanced automation technologies to enhance their productivity (**Kraur & Gill, 2003, p.119**). Countering the claims that technology is easily imitable and cannot be relied upon to confer competitive advantage to firms, **Ran** (**2014, p.184**) points out that new technologies have proved very useful in shortening production lead times while also reducing operational costs, thereby enabling companies to respond swiftly to market as well as customer needs.

In the automotive industry, companies are significantly making use of advanced technologies. It is not uncommon today to find vehicles into which on-board computers have been fitted in for ease of managing how engines are performing. On-board computer systems are also being used in automobiles for temperature control purposes. There are even driverless vehicles on pilot testing that are awaiting commercialisation (**Dubey, 2017 p.66**).

Although new technologies are applicable across all functions within an organisation, attention is drawn to the finding that firms can find some solutions to the questions or challenges they have regarding the supply chain by making use of advanced technologies such as the Internet of Things and Big Data analytics. Today's environment is hypercompetitive to the point that "competition is among supply chain networks rather than individual firms" (**Lee, 2017 p.76).** The explanation for this is that supply chains have become the fundamental organising unit within contemporary global industries. On a different note, advanced technologies such as the Internet of Things-IoT- are opening up hitherto non-existent business opportunities, and this means that the IoT revolution generates a substantial impact on the supply chain.

Trough the IoT technologies, automotive companies are able to monitor and even control supply chain operations such as transportation, production and logistics. Precisely, the Internet of Things can help automotive companies to gather and disseminate data regarding equipment performance, asset condition and energy usage (**Lee, 2017 p.78**). Consequently, managers are in a position to respond swiftly and appropriately to changes anywhere and anytime they occur.

Closely related to the IoT is the concept of Big Data, which is based on the truth that technological advancements such as mobile devices and the internet are generating data at unparalleled rates. Subsequently,

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companies are confronted by extraordinary challenges in as far as collecting, storing, processing and analysing data is concerned (**Rocha et al., 2017 p.175**). Thankfully, the same technological developments are being used to facilitate the process of gathering, storing and processing data. Here, data obtained from different devices or machines are fed into "a cloud datacenter and merged into a supply chain-wide database for simulation, data analytics and optimisation" (**Lee, 2017 p.80**). In simple language, Big Data analytics help companies to manage their supply chains effectively and enhance their competitive advantage by facilitating predictive fleet maintenance, customer service, demand forecast and delivery lead time.

The Toyota Company has embraced the concepts of the Internet of Things and Big Data analytics. In an article published in the Wall Street Journal, **Lobenstein** (**2016, para.2**) discloses that "Toyota sees the internet of things as an enabler of mobility…[and that] big data generated by sensors located throughout [the company's] cars will help engineers develop automobiles that think for themselves". In simple language, this is to say that the Toyota Company strives to maintain its competitive advantage by embracing advanced technologies that have the potential of enabling the carmaker to develop smart cars that are not only fun to drive but are also safe and reliable. Toyota is looking forward to delivering cars with unique features that respond to the needs of drivers who may be gifted differently –those with special needs.

Through advanced technologies, the Toyota Company has developed the Lexus model that offers services such as Destination Assist, a unique feature through which drivers are linked up with live agents that offer directions on how to move from one point to another. Similarly, Toyota's Lexus vehicles are able to keep the driver or owner updated about the health of the car, providing updates on oil levels, maintenance needs and tire pressure among others (**Lobenstein, 2016 para.2**).

Conclusion

The external environment in which companies do business is characterised by unpredictable, inevitable occurrences and forces that considerably a company's strategy. On top of this, globalisation and mobility of factor inputs have intensified competition in the market, making it necessary for firms to embrace any developments or strategies that have a potential of enhancing or at least enabling them to maintain their competitive advantage. Advanced technologies, namely the Internet of Things and Big Data analytics, have been established as sources of competitive advantage. Likewise, collaboration, agility and lean principles can effectively be used to configure supply chains and confer a sustainable competitive advantage on firms.

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ORCID 0009-0008-6625-9337

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