Supply Chain Analytics and Competitive Advantage: An Empirical Study of the Indian Automobile Industry

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Abstract

The present study empirically evaluates the role played by three components of the supply chain analytics, namely, Demand and Inventory Management Analytics, Procurement Analytics, and Logistics Analytics, to achieve competitive advantage in the Indian automobile industry. Using questionnaire, cross-sectional data were collected from 104 first line supply chain managers of 65 automobile firms in Bangalore, India. The responses were recorded using the Likert scale, and later analysed using the SPSS software. The findings of the study revealed that although some of the requirements of the three components are met in the organisation, the performance of the three components of supply chain analytics was not sufficient to enhance the organisation's competitive advantage. Organisations should focus on suppliers as they are the most important link in the supply chain. Further, the results also suggest that the automobile firms need to put in place an internal check to comply with the Supply Chain Analytics. The Indian automobile firms have a long way to go in attaining efficiency and a competitive edge.

Keywords: Supply Chain Analytics, Automobile Industry, Demand Analytics, Procurement Analytics, Logistics Analytics

Introduction

The automobile industry, accounting for 22% of the country's manufacturing GDP, holds an important position in the Indian economy. The Indian auto industry, consisting of passenger cars, two-wheelers, three-wheelers and commercial vehicles, is the seventh largest industry in the world with an annual production of 17.5 million vehicles, out of which 2.3 million vehicles are exported (Sarangi, Bano, & Pant, 2014). The Indian automobile industry is unaffected from the global financial crisis as it has adopted innovative strategies and alternative remedial measures.

The multinational firms in the Indian automobile industry have been highly successful in attaining a competitive advantage over their global counterparts, despite the fact that the Indian automobile industry is characterised by high raw material and energy costs, and poor infrastructure. This has largely been made possible by the efficiency attained in the supply chain management of the firms (Babu, 2012). Capitalising on supply chain (SC) capabilities and resources is required to bring products and services faster to the market, at possible low costs, with appropriate features and the best overall value (Gunasekaran *et al*., 2001 cited in Kurien & Qureshi, 2011).

Trkman, McCormach, Olieviera, and Ladeira (2010) assert that the competition is no longer between organisations, but among their supply chains (SC). Therefore, effective supply chain management (SCM) is a must to improve organisational performance.

The rapid supply chain transformations prevalent in the present competitive scenario can be addressed using varied business processes. However, in order to achieve a greater value from these transformations, building analytics that are in line with the strategic business objectives and new supply chain processes are indispensable (Infosys, 2011).

The incorporation of analytics in the Supply Chain Management (SCM) of the Indian automobile firms has enabled them to know what products their customers want, what prices they are willing to pay, how frequently will they buy in their lifetime, along with what factors encourage them to buy. Moreover, SCM has contributed

towards computing compensation costs, turnover rates, and relationship between salary and performance, as well as knowing the times of low inventory levels. Additionally, it can predict problems with the demand and supply chains, and also help in achieving a high rate of perfect orders (Davenport, 2006).

Giannakis and Croom (2004) used their own research study as well as earlier studies to develop a framework listing three major processes required in a SC namely synthesis, synergy, and synchronisation, which relate to the branches of the SC namely, the physical structure of SC, the human interaction and relations within it, and the coordination and control of operations and processes across the SC.

Henderson *et al*. (1992) and Fairbank *et al*. (2006) proposed the information processing theory to prioritize the most critical performance factor pertaining to the linkage between a key organisational resource (information) and its management (the use of information) (Trkman *et al*., 2010). This serves as the most important objective of SCM in order to improve the processes and/or outcomes.

To create a successful SCM it should be understood that the performance of a firm is significantly influenced by the actions taken by other firms in its supply chain or networks (Giannakis & Croom, 2004).

India's competitive advantages can be effectively combined with other advantages, in order to establish collaborative operations and result in a win-win opportunity for boththe Indian automobile industry as well as its global counterparts (Ray, 2012).

Additionally, the Indian economy must take its present obstacles into account. For instance, India faces huge logistics costs due to its reliance on road transportation, which severely impedes the SC (Kearney, 2013).

Aim of the Study

The present study aims at evaluating the role played by three components of the supply chain analytics in achieving competitive advantage in the Indian automobile industry.

Objectives

1. To assess the performance of the Demand and Inventory Management Analytics in automobile firms.
2. To assess the performance of the Procurement Analytics in automobile firms.
3. To assess the performance of the Logistics Analytics in automobile firms.

Literature Review

Over the past several decades, the organisational environment has become increasingly more diversified, uncertain, and complex. This has forced the companies to manage their operational strategies in a way that absorbs this change over the years, by restructuring the supply chain (Sanchez & Perez, 2005). Further, the performance of these firms in a global market is being determined not only with respect to manufacturing activities, but also to a great extent by its supply chain logistics and management.

According to Kearney (2013), the SC can be a successful growth driver for a firm, if it has specific features that make it competitive, efficient, and overall successful. *Responsiveness* or the ability of the supply chain to respond rapidly to a sudden increase or an unanticipated supply disruption is an important focal area for firms which help them gain market share. *Readiness* in the supply chain is another feature that helps firms to spearhead competitiveness, by embedding features related to the delivery of quality, freshness and sustainability into their processes.

According to Suthikarnnarunai (2008), demand visibility, capacity flexibility, supplier flexibility, and logistics flexibility are essential components to achieve an exemplary SCM.

A tailored supply chain, i.e. personalising each stage/ process based on its own standards and requirements has been reported to work well for Indian automobile industry.

Fisher (1997) emphasized on offering supply chain tailored to meet the specific requirements of the product, especially for the complex automotive industry. Indian auto industry therefore should align its supply chain practices to organisation strategies to increase its competitive advantage (Sahay, Gupta, & Mohan, 2006). The effectiveness of supply chain is largely affected by growth of the automotive industry as it is widely connected to other industries.

Therefore, Kearney (2013) has stressed on the importance of focusing on metrics for each segment and putting in place an internal check on its compliance, thus achieve clarity in the entire process.

Demand and inventory management is seen as one of the most critical and challenging aspects of supply chain analytics. Several strategies are recommended for a firm to manage demand and inventory. However, the main focus should be on effective and efficient long-term planning for all processes starting from production to the final despatch of products. Kearney (2013) advocates collaboration of processes across various functions which can lead to overcoming of challenges, obtaining readiness and competitive advantage, thus increasing geographical reach of products. Eventually, such collaboration can result in value creation in the entire SC. *Forecast Analytics* serves as another crucial step in favour of an efficient SCM. At various stages of implementation, namely, pre-demand implementation, demand implementation, and post-demand implementation, forecast analytics is reported to have resulted in tangible benefits, such as reduction in product obsolescence with improved life cycle management, reduction in stock-outs, etc. (Colomina, 2009). Kearney (2013) believes that consumer durable companies in India have displayed effective usage of real time demand-based weekly planning cycle, which has enabled them to respond faster to volatility.

As firms enter into new, competitive, and volatile markets, besides being challenged with diversified product portfolios, they are faced with a major task of managing a multitude of local and global suppliers. According to Minahan and Vigorose (2002), if the firms fail to measure the supply base and focus only on the giant suppliers to its product base thus ignoring the small local suppliers, they would probably expose themselves to serious risks. These risks could be in the form of large-scale quality mishaps, service deficiencies, and cost overruns that can damage their competitive positioning in the global market.

Suppliers, being an important link in the SC, must have certain characteristics to achieve successful implementation of the planned SCM. Vonderembse and Tracey (1999) indicated that decision-makers need to pay attention to a set of serious supplier-selection criteria that could evaluate across multiple aspects including product quality, product performance and delivery reliability (Sagar & Singh, 2012). Other issues for which the supplier performance metrics are an integral part of the SCM are related to on-time delivery of product, maintenance of competitive market price, control of the total cost, assurance of contractual compliances, management of lead times, to name a few (Minahan & Vigorose, 2002). Besides, supplier flexibility plays a vital role in SCM, any sudden shifts in demand must trigger the real output. This further ensures a timely and appropriate supplier responsiveness (Suthikarnnarunai, 2008).

Rapidly fluctuating demand patterns accompanied by a widespread base of suppliers impose upon the automobile firms to continuously rethink their *logistics network strategy*. Logistics flexibility is an important attribute to be inculcated in the SCM to achieve a lower cost of sale incentives and lower inventory cost for the entire chain. Location of the suppliers is another component that is increasingly gaining attention in order to minimise the distribution time and resources employed. More recently, there has been an argument in favour of suppliers being asked to send components in smaller lots with higher delivery frequency. However, this requires creation of a cross dock between suppliers and the vehicle assembly plant so as to counter the high inbound logistics costs (Suthikarnnarunai, 2008).

The firms must ensure that the global network has excellent visibility and high service levels. The customers must have a transparent visibility into the complete product life cycle from design through disposal. This may require adopting varied models and processes to support the increasingly diverse channels and customer needs, and thereby achieve the targeted supply network flexibility (Sharma & Sharma, 2012).

The extant of literature on the integration of analytics in the SCM practices points to the need for integrating people, process, tools and technology, along with an alignment of each element into the overall system in order to provide the optimised level of outcome.

An appropriate example of the implementation of SCM to achieve a competitive advantage in the automobile sector could be that of the Indian assemblers, typified by Maruti, who have efficiently built a formidable distribution and after-sales network, an established supplier base that has helped them attain advantages of cost and delivery time. However, these firms still lag behind in terms of product design capability, therefore, must improve on it to retain their competitive edge (Ray, 2012).

The particular case of Toyota adopting a new concept of lean manufacturing placed customers into the first process of production development by creating customer-defined value and using it to drive other processes. The main idea behind this was that improvements made in the early stages of product development were expected to have much higher impact as compared to improvements in the later stages (Suthikarnnarunai, 2008).

Achieving a competitive advantage through the efficient use of supply chain analytics in the automobile industry has clearly been a win-win situation for the Indian firms aiming to become global giants. Following an

all-encompassing approach, as done by major Indian automobile firms, helps in designing an efficient and successful supply chain.

Hypothesis

H_0a: The components of Demand and Inventory Management Analytics are performing well in the company to be able to enhance competitive advantage.

H_1a: The components of Demand and Inventory Management Analytics are not performing well in the company to be able to enhance competitive advantage.

H_0b: The components of Procurement Analytics are performing well in the company to be able to enhance competitive advantage.

H_1b: The components of Procurement Analytics are not performing well in the company to be able to enhance competitive advantage.

H_0c: The components of Logistics Analytics are performing well in the company to be able to enhance competitive advantage.

H_1c: The components of Logistics Analytics are not performing well in the company to be able to enhance competitive advantage.

Research Methodology

The research has been conducted using a specific framework in mind, to achieve the overall objectives of the study. This research has broadly utilised the descriptive research design which aims to 'portray an accurate profile of persons, events or situations' (Saunders *et al*., 2009). It has used the understanding gained from earlier researches about the concept of SC, SC analytics and SCM, and then used that understanding to collect data.

Research paradigms fall into two categories namely, positivism and interpretivism. This study however, is a continuum of both types of philosophies. Therefore, we describe this research to have followed the philosophy of realism. The study shows attributes of interpretivism, since the researcher has gathered engaging information from its samples for examining the issue proposed, i.e., the performance of the three variables under study. Along with this, the study also follows positivism since it uses tests by investigating numerical data gathered from its 104 primary respondents.

The research theme follows a deductive approach, in the sense that it uses a pool of background studies for including specific elements/components of the supply chain analytics and then formulated its own hypothesis to further test them in a given sample, so as to confirm the validity of the proposed theories in SCM.

A formalised, unconcealed, closed-ended questionnaire for collecting cross-sectional data from a sample of 104 first line supply chain managers, covering a total of 65 firms in Bangalore, India was used. Convenience random sampling was followed for sample selection, thereby providing the researcher a reliable and representative dataset. Likert scale is the major tool employed for collecting information from the samples, which has been used for the present study as the study aims to assess the performance of the various components of SC analytics in the firms under study. The Likert scale has divided the evaluation of performance levels into five categories namely, Strongly disagree, Disagree, No opinion or uncertain, Agree, and Strongly agree. SPSS software has been applied for performing a statistical analysis of the data collected, to statistically test the applicability of the three hypotheses of the study.

Results and Discussion

A significant 62.5% of the sampled first line supply chain managers recognised SC analytics as a solution for the supply chain decision services. This is in line with the results obtained in the study by Gunasekaran *et al*. (2001) which emphasised the requirement of SC analytics so as to achieve an overall enhancement.

Regarding the performance of the firms in maintaining up-to-date performance metrics and reporting, approximately 51% of the respondents agreed (agreed/strongly agreed) that their respective organisation is a dept in the task. As opposed to this, only 31% disagreed (disagreed/strongly disagreed) on the same.

Another most recent trend in the automobile firms for successfully attaining a competitive advantage through SC analytics is the following of a multi-criteria inventory classification. The present study too has shown a prevalence of the same. The results show as 34% and 25% reporting for agreed and strongly agreed, respectively, for a multi-criteria compliance being followed in their firms. The insignificant 4% disagreed on the same and supported the claim that a vast majority of firms are trying to incorporate SCM into their organisations in some way or the other.

However, approximately 31% of the respondents reported that there is no/uncertain demand forecasting done in their firms. This is worth observing since the total percentage of respondents who strongly disagreed (when asked whether demand forecasting is done regularly) or were uncertain is significantly high at 54%.This non-compliance to a necessary requirement for effec management of the SC, as proposed by Kearney (2013),will hamper the readiness of the firm's supply chain and can negatively affect the firm's achievement of set targets. However, opposing to this, approximately 35% of the respondents reported that their firm rapidly adjusts its capacity to tackle the demand changes. The study obtained a mixed opinion about the optimisation of service level. On the one hand, 29% agreed that their firm acts quickly for optimisation, while on the other, 23% disagreed. However, 75% agreed/strongly agreed that their firm responds quickly to modifications in product volume as demanded by customers.

Another component of the demand and inventory analytics was missing from the survey results. Approximately 29% of the respondents strongly disagreed that the firm's product obsolescence visibility report is available all the time.

Thus, it can be argued that although the firms have not been found to follow proper SCM practicesfor all the components of demand and inventory analytics, it is still able to adjust itself to sudden shocks. However, it is seriously doubted as to whether this can successfully be continued forever. Thereby, on testing the first hypothesis considered for the present study, the results also rejected the null hypothesis and it was concluded that the demand and inventory analytics did not perform well in the company.

As far as the study findings for the high efficiency of procurement strategy support, the results show that a significant 68% respondents agreed/strongly agreed for the same. However, on the contrary, 37% of the respondents also showed up a disagreement (or strongly disagreed) or were uncertain about the efficiency of procurement strategy support. In addition to the procurement, the vendor selection policies were also deemed as being objective oriented, as reported by a majority of 40%.

Further, 48% of the respondents strongly favoured that their firm has the ability to quickly regulate warehouse capacity to address the changes in demand. To effectively manage such unpredictable situations, a majority also accepted that the suppliers consistently accommodated their requests. Another positive vendor-related feedback was revealed in the study findings which were related to 40% reporting that vendor performance metrics are documented in their firm. A major finding related to the procurement analytics was a strongly agreed 35% reporting that the vendors were given feedback about the improvement areas. However, this was valid only for a limited number of respondents, as almost 43% of the respondents disagreed/were uncertain about the same, indicating that the feedback is not given to vendors. A significant positive reporting was also observed by the respondents who agreed that their firm provides a sufficient scope and environment for speedy development of new products. However, despite a relatively higher reporting in favour of the components for procurement analytics being prevalent in the firms, a large proportion of the respondents also disagreed/strongly disagreed for the same. Moreover, if the combined effect of strong disagreement is analysed, the proportion gets unavoidable. For instance, despite the majority of 35% respondents strongly agreeing that the firm follows network optimisation techniques for rapid delivery, 37% disagreed or were uncertain about the same. Therefore, in line with these findings, on testing the second hypothesis for the study, the SPSS analysis results rejected the null hypothesis that the procurement analytics are performing well.

For the third component of logistics analytics too, the hypothesis that they are performing wellgot rejected. Approximately 34% of the respondents were found to have no opinion or were uncertain about whether major suppliers provide quick inbound logistics to them. Further, a total of 15% also disagreed (or strongly disagreed) on the same. Only 37% of the respondents agreed that carrier sourcing is done according to the order processing documents.

The only two components, for which a significant positive agreement was noticed, were the freight lane management and delivery of expedited shipments. The study results revealed that 42% of the respondents in this study agreed that freight lane is managed efficiently. Approximately 47% of the respondents also agreed that the firm effectively delivers expedited shipments.

Therefore, the SPSS analysis results rejected the null hypothesis and it can be concluded that the components of logistics analytics are not performing well in the company to be able to enhance the firm's competitive advantage.

Conclusion

The inventory classification done by organisations, based on various different criterions, is becoming increasingly common among Indian automobile firms, so as to efficiently re-organize their SCs. The most frequently

used classification as per the relative importance - very important, averagely important and relatively unimportant - has helped these firms in managing their time and resources in a better way (Rezaei, 2010). This has been possible due to the adequate attention given to the more important items.

Suppliers being the most crucial link in the automobile sector need to be managed with a greater focus, catering to aspects from their selection to the after-sales services. This could serve to manage the procurement part efficiently and securing the firms of any delays/faults from the supplier's side.

A major lesson for these firms can be the strict adherence to the necessary fulfilments required for a successful SCM. As observed from the study results discussed above, a majority of the firms was found to lack a regular demand forecasting being carried out.

The Logistics analytics seem to be the most ignored in the present study results. A significantly large proportion of respondents disagreed or was uncertain on the functioning of the major components of the logistics analytics. The urgent requirement for these firms is ensuring logistics flexibility, so as to effectively alter the management of the entire process.

Thus, the firms need to put in place an internal check on its compliance, which helps to achieve clarity in the entire process of supply chain management (Kearney, 2013).

Although the trend of following a tailored supply chain is prevalent in the firms, and is effective too, there is still a long way to go for the Indian automobile firms, in terms of attaining efficiency by focusing on each and every component of SC analytics.

Further, the spread of the usage of SCM has not been extensive and many firms are still far from an effectively planned and implemented SCM.

A further study on why these particular components have not been incorporated efficiently in these firms can be a useful source of knowledge. Identifying the major challenges faced by these automobile sector firms and further suggesting the solutions/recommendations for the samecan significantly improve the overallstatus of SCM in India.

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