African Journal of Business Management Vol. 5(17), pp. 7557-7563, 4 September, 2011
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM11.596
ISSN 1993-8233 ©2011 Academic Journals

Full Length Research Paper

Improving supply chain performance: The strategic integration of lean and agile supply chain

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Accepted 27 May, 2011

By emergence of new areas of business in which change is an inevitable feature, it is difficult to survive and succeed in the manufacturing systems. In other words, business environment changes and today's work which results from changes in customer needs leads to uncertainty in parameters. Therefore, it is necessary for supply chain to be flexible in decision making while encountering these uncertainties. For supply chain performance to be more improved in this paper, first, the patterns of lean and agile supply chain will be examined, then by introducing Leagilty Supply Chain, the relationship between product life cycle of different products (standard, innovative, hybrid) and selection of the proper type of supply chain will be examined.

Key word: Leanness, agility, leagility, supply chain management, product life cycle.

INTRODUCTION

The turbulent market conditions in the 21st century have heightened the need for more competitive strategies to be developed for growth (Sánchez and Pérez, 2005). Business, economics and the political environments are increasingly subjected to unexpected shocks and discontinuities. Many strategic issues that confront business today stem from: the new rules of competition, globalization down pressure on price and the customer taking control. Also, as a result of the recent economic meltdown, companies around the world are confronted by a perfect storm: frozen credit market and long global recession. Events are moving so rapidly that it is almost impossible to access the implication of the meltdown for the days ahead, let alone the years to come (Njoroge, 2009).

Enterprises are continuously paying attention to responding to the customer demand for maintaining a competitive advantage over their rivals. Supply Chain Management (SCM) has gained attention as it focuses on material, information and cash flow from vendors to customers or vice-versa. One of the key features of present day business pertaining to the idea which holds it is Supply Chain (SC) that competes, not companies (Christopher and Towill, 2001), as well as the success or failure of supply chains, is ultimately determined in the market place by the end customer. Getting the right product, at the right time to the consumer is not only the linchpin to competitive success, but also the key to survival. Hence, customer satisfaction and market place understanding are critical elements for consideration when attempting to establish a new supply chain strategy (Agarwal et al., 2006).

The popularity of supply chain management is characterized by several deriving forces, that is, global sourcing, and an emphasis on time and quality based competition and their respective contributions to greater environmental uncertainty. In this dynamic business environment, the competitions are based on time and quality. Providing defect free product to the customer on time is the fundamental requirement to be a successful organization. In order to meet such requirements, a closer coordination with suppliers and distributor is essential (Tarofder et al., 2010). The main issue is that what is the appropriate strategy in the use of supply chain? Is agile supply chain always better than lean supply chain? Or it depends on certain conditions? A supply chain must have the following conditions:

1. Consistent with the type of organization's productive product
2. Consistent with life stages of the product over the whole supply chain

3. Compatible with changing the product type
4. Continuous dynamics in turbulent and competitive environment of supply chains

Therefore this research is looking to provide a complete definition of the types of supply chain and ultimately I will prove their relationship with the type of products.

SUPPLY CHAIN PERFORMANCE

A supply chain consists of all parties involved, directly or indirectly, in fulfilling a customer request. The supply chain not only includes the manufacturer and suppliers, but also transporters, warehouses, retailers, and customers themselves. Within each organization, such as manufacturer, the supply chain includes all functions involved in receiving and fulfilling a customer request. These functions include, but are not limited to, new product development, marketing, operations, distribution, finance, and customer service. A supply chain is dynamic and involves the constant flow of information, product, and funds between different stages. The primary purpose of the existence of any supply chain is to satisfy customer needs, in the process generating profits for itself. Supply chain activities begin with a customer order and end when a satisfied customer has paid for his or her purchase. The term supply chain conjures up images of product or supply moving from suppliers to manufacturers to distributors to retailers to customers along a chain. It is important to visualize information, funds, and product flows along both directions of this chain. The term supply chain may also imply that only one player is involved at each stage. In reality, a manufacturer may receive material from several suppliers and then supply several distributors.

A typical supply chain may involve a variety of stages. These supply chain stages include:

1. Customers
2. Retailers
3. Wholesalers/Distributors
4. Manufacturers
5. Component/Raw material suppliers

Not every one of these stages is needed to be present in a supply chain. The appropriate design of the supply chain will depend on both the customer's needs and the roles of the stages involved (Chopra and Meindl, 2004).

Supply Chain is described as a chain linking each element from customer and supplier through manufacturing and services so that flow of material, money and information can be effectively managed to meet the business requirement. Most of the companies realize that in order to evolve an efficient and effective supply chain, SCM needs to be assessed for its performance (Gunasekaran et al., 2001).

Lee and Billington (1995) define a supply chain as a network of facilities that procures raw materials, transforms them into intermediate goods and then final products, and delivers the products to customers through a distribution system. The management of such a network requires mastery of optimization logistics, or the specific quantity of goods needed at a particular time and price. Clearly, relationships with suppliers that make up these networks are a central component to successful supply chain management.

The success and failure of supply chains are ultimately determined in the marketplace by the end consumer. Getting the right product, at the right price, at the right time to the consumer is not only the lynchpin to competitive success but also the key to survival. Hence, consumer satisfaction and marketplace understanding are crucial elements for consideration when attempting to establish a new supply chain strategy. The initiatives for the improvement of Supply Chain performance strive to match supply and demand, thereby driving down costs simultaneously with improving customer satisfaction (Mason-Jones et al., 2000).

Supply chain management can be defined as "the design and management of seamless, value-added process across organizational boundaries to meet the real needs of the end customer" (Fawcett et al., 2007). As noted by Gansler et al. (2004), SCM is the management and control of all materials, funds and related information in the logistics process from the acquisition of raw materials to the delivery of finished products to the end user. Hugo et al. (2004) defines "SCM as the management philosophy aimed at integrating a network of upstream linkages (sources of supply), internal linkages inside the organization and downstream linkages (distribution and ultimate customer) in performing specific processes and activities that will ultimately create and optimize value for the customer in the form of products and services which are specifically aimed at satisfying customer demands". Generally, SCM involves relationships and managing the inflow and outflow of goods, services and information (network) between and within producers, manufacturers and the consumers (Samaranayake, 2005).

The objective of SCM is to maximize value in the supply chain. The value a supply chain generates is the differences between what the final product is worth to the customer and the costs that supply chain will in-cure to fulfill the customers' request (Marcus, 2010). SCM is about competing for value, collaborating with customers and suppliers to create a position of strength in the marketplace based on value derived from end consumer (Chopra and Meindl, 2007). Within an organization, customer value is created through collaboration and cooperation to improve efficiency (lower cost) or market effectiveness (added benefits) in ways that are most valuable to key customers. Value is not inherent in products or services, but rather is perceived or experienced by the customer (Handfield et al., 2009). The ultimate

goal of a SCM process is to create customer and shareholder value, thus often called a value delivery system.

Lean supply chain (LSC)

Lean production was developed at Toyota after a Toyota delegation visited Ford's car factories in the US and realized that they never could serve the small home market with a full array of types of cars using the technologies of mass production. So, they started to develop techniques that allowed them to produce flexibly as batch size 1 (Vonderembse et al., 2006).

A Lean Supply Chain (LSC) employs continuous improvement efforts that focus on eliminating waste or non-value steps along the chain. It is supported by efforts to achieve internal manufacturing efficiencies and step time reduction, which enable the economic production of small quantities and enhance cost reduction, profitability, and manufacturing flexibility to some degree. The short setup times provide internal flexibility, but a LSC may lack external responsiveness to customer demands, which can require flexibility in product design, planning and scheduling, and distribution in addition to manufacturing (Both, 1996).

As the rate of market change increases, the LSC approach has evolved into "multiple niche competition", which is the production of any volume, even a single unit, combined with the ability to satisfy multiple market segments. Organizations recognize that along with the added variety and responsiveness squeeze, they must remain adaptable to future changes. Customer requirements are continuously evolving (on the one side) and product life cycles are growing shorter (on the other side), therefore, along with being lean, supply chains must respond to the market. As a result, successful organizations move from concept to cash flow in a fraction of the time (Vonderembse et al., 2006).

Agile supply chain (ASC)

Agility is vital ability in the revolutionary turning of the business environment into a turbulent place of competition and struggle for success. Agility is the ability to detect the changes in the business environment, and responding to them by providing the appropriate capabilities (Sharifi and Zhang, 1999).

The Agile Supply Chain (ASC) paradigm relates to the interface between companies and markets, an external perspective on flexibility. An ASC focuses on responding to unpredictable market changes and capitalizing on them through fast delivery and lead time flexibility. It deploys new technologies, methods, tools, and techniques to solve unexpected problems.

Leagile supply chain: beyond lean and agile?

The establishment of a new supply chain strategy depends on the consideration of two foremost critical elements, the customer satisfaction and marketplace understanding. A manufacturing enterprise can endeavor to develop a strategy that will meet the requirement of both the supply chain and end customer, only when the constraints of the marketplace are understood (Chan et al., 2009).

Lean focuses on the elimination of basically seven types of wastes that are overproduction, waiting time, time incurred in transportation, inventory, motion, defective units, and overprocessing. Agile production system emerged as an alternative to the lean principles (Richards, 1996). Agile strategy aims at using the market knowledge and virtual cooperation to utilize the advantageous opportunities in a volatile marketplace. It focuses on the adaptation according to the changes in the market.

Both the lean and agile strategies have proven their usefulness in their respective situations, but the present market scenario demands a more robust strategy that can encapsulate the salient features of both. This gave birth to a new strategy termed as "Leagile". The leagile strategy combines the lean and agile principles through a decoupling point, which separates the production line into two parts at the point of product differentiation (Naylor et al., 1999). Analytical process for improving supply chain performance is depicted in Figure 1.

Leanness and Agility in a supply chain do not have to exclude each other, however, Lean Supply Chain paradigm, with its focus on advanced standardization as the way to improved efficiency, can discourage innovation, differentiation and complex learning needed to carry on the change. Leanness is about doing more with less. Agile Supply Chain operations are market sensitive, network based, with process alignment and virtual operations. Combination of these two concepts within the scope of one firm or a single supply chain can be called as "Leagility". Table 1 presents the distinguishing attributes of the associated supply chains.

STRATEGIC RELATION BETWEEN SUPPLY CHAIN AND PRODUCT LIFE CYCLE

LSC focuses on reducing lead time, increasing efficiency, expanding manufacturing flexibility, and cutting cost. LSC approach attempts to build a level schedule across the supply chain, and it uses pull production to respond to customer demand. While striving for these goals, the LSC focuses on incremental improvements (Kaizen). It tries to improve the product and the associated processes, by balancing the supply chain.

The long product life cycle of standard product provides a stable design over many years. Being a low cost item, globally manufactured, with highly predictable demand

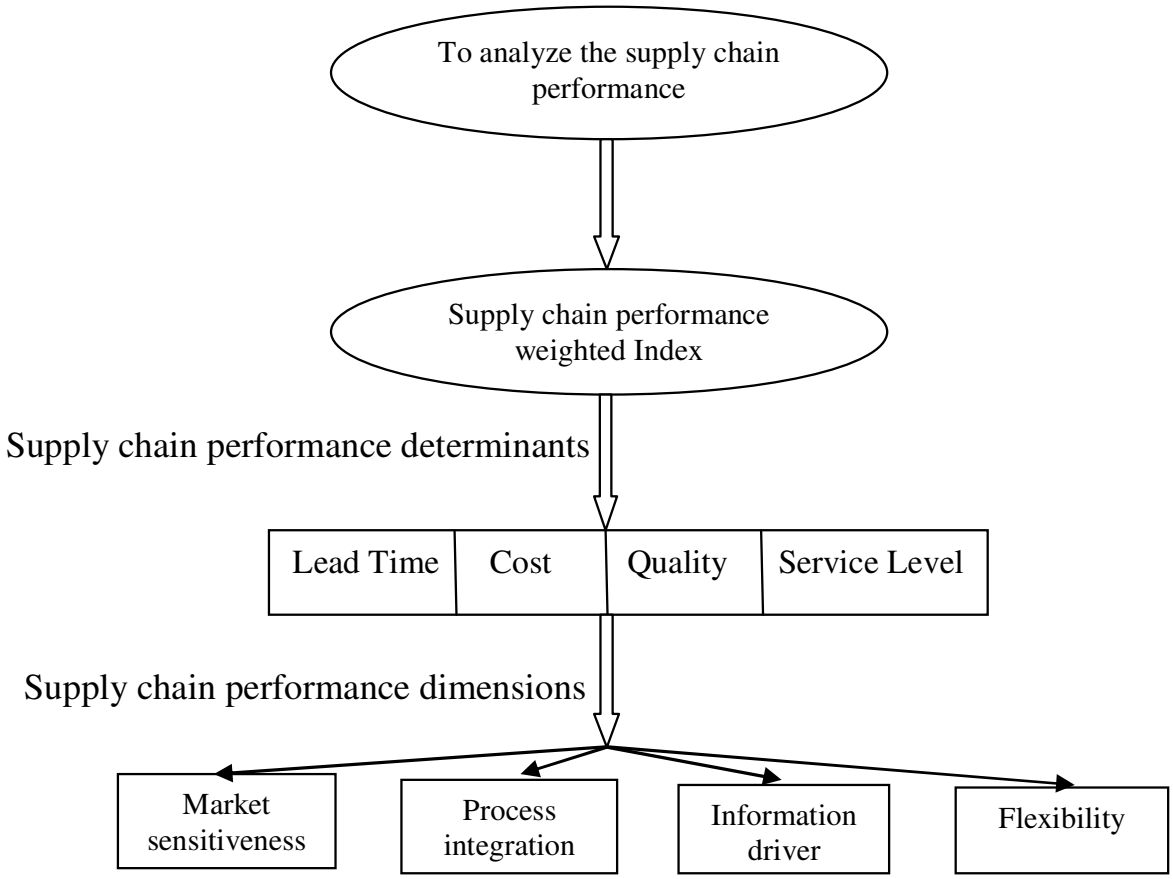

Figure 1. Analytical process for improving supply chain performance. (Agarwal et al., 2006).

Table 1. Comparison of lean, agile, and leagile supply chain.

Distinguishing attributes	Lean supply chain	Agile supply chain	Leagile supply chain
Market demand	Predictable	Volatile	Volatile and unpredictable
Product variety	Low	High	Medium
Product life cycle	Long	Short	Short
Customer drivers	Cost	Lead-time and availability	Service level
Profit margin	Low	High	Moderate
Dominant costs	Physical costs	Marketability costs	Both
Stock out penalties	Long term contractual	Immediate and volatile	No place for stock out
Purchasing policy	Buy goods	Assign capacity	Vendor managed inventory
Information enrichment	Highly desirable	Obligatory	Essential
Forecast mechanism	Algorithmic	Consultative	Both/either
Typical products	Commodities	Fashion goods	Product as per customer demand
Lead time compression	Essential	Essential	Desirable
Eliminate muda	Essential	Desirable	Arbitrary
Rapid reconfiguration	Desirable	Essential	Essential
Robustness	Arbitrary	Essential	Desirable
Quality	Market qualifier	Market qualifier	Market qualifier
Cost	Market winner	Market qualifier	Market winner
Lead-time	Market qualifier	Market qualifier	Market qualifier
Service level	Market qualifier	Market winner	Market winner

Sources: Naylor et al. (1999), Mason-Jones et al. (2000), Olhager (2003), Bruce et al. (2004).

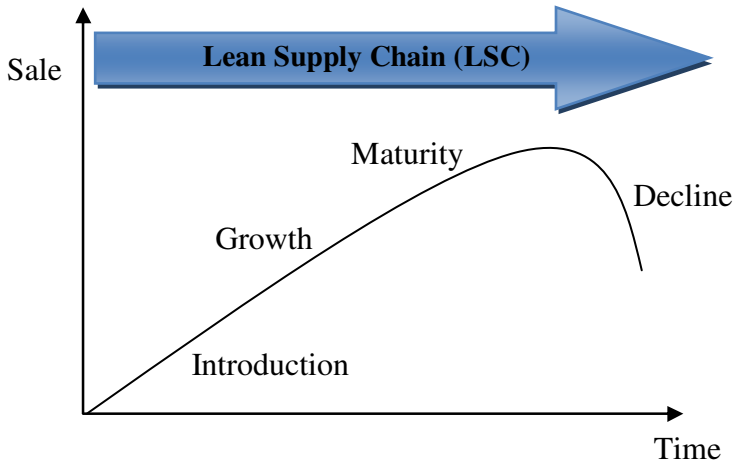

Figure 2. Standard Product Life cycle.

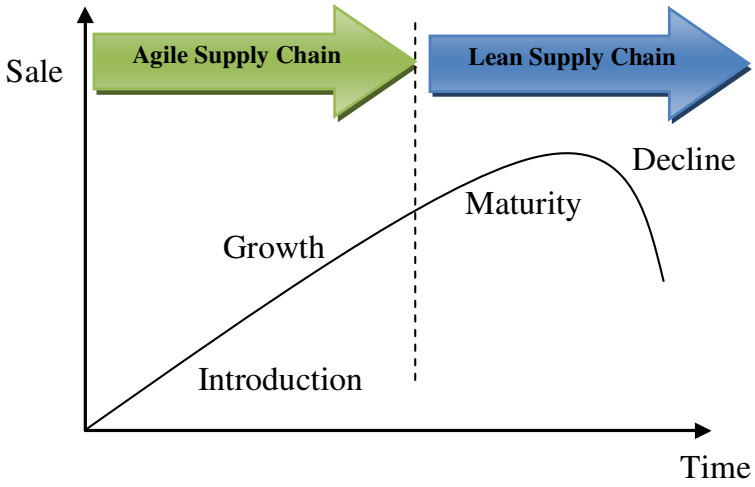

Figure 3. Innovative Product Life Cycle.

patterns, profitability can be achieved by minimizing cost and employing a level schedule over the entire supply chain and over all the products life cycle stages (Mason-Jones et al., 2000). This justifies the usage of a LSC for standard products (Figure 2). In addition to providing cost minimization, the LSC is efficient and flexible, and it brings about incremental improvements, permitting firms to constantly improve the quality of their products and keep their customers satisfied.

Thus, to have the highest internal performance and customer satisfaction, standard products should be designed and produced by lean supply chains through all stages of the product life cycle.

In order for innovative products to succeed, they should be producible in any volume, as per customer requirements. The first two stages of the product life cycle, introduction and growth, are the testing grounds to ensure that organizations are achieving customization and market adaptability. Once the product has been firmly established, it transitions into third stages of its life cycle, maturity. By this stage, the innovative product begins to take on the characteristics of a standard product.

Thus, to have the highest internal performance and customer satisfaction, innovative products should be designed and produced by agile supply chains in the introduction and growth stages, and lean supply chains in the maturity and decline stages of the product life cycle (Figure 3).

Hybrid products, which are complex, require the organization to bring together a set of suppliers with a wide range of capabilities (Choi and Hong, 2002). This implies innovative and standard products as well as strategic partnerships. While it may be true that hybrid products that are near the end of their life cycle may use fewer

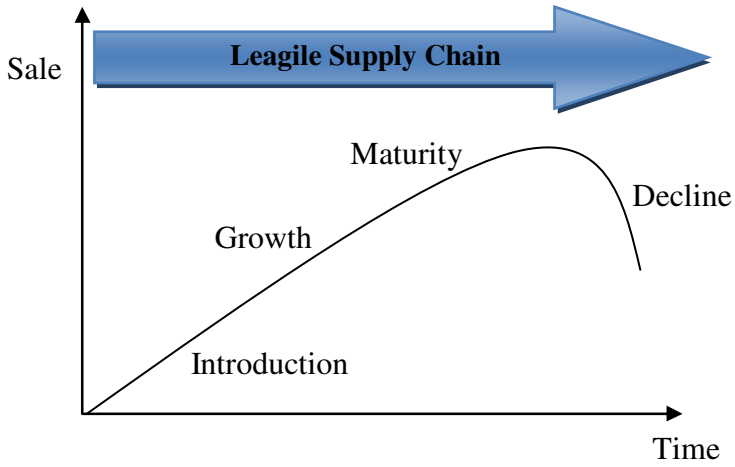

Figure 4. Hybrid Product Life Cycle.

innovation components than a product that is all the beginning, there is always the opportunity to introduce innovation into the hybrid product. As a result, hybrid products require Leagile Supply Chain throughout their product life cycle.

Thus, to have the highest internal performance and customer satisfaction, hybrid products should be designed and produced by leagile supply throughout the product life cycle (Figure 4).

Conclusion

Lean and agile patterns in the supply chain are today the main focus of many manufacturing companies (today) which are seeking to improve performance. Each of the above views, that is, Lean and agile patterns have their own specific advantages and strengths, points and have maximum efficiency in the specific situations. In fact by considering different features and situations of productive organizations and systems it is possible to take profit from any of them or both of them. Clearly, the development of theories and researches in this area requires an understanding of these two models. Moreover, their differences, barriers and constraints without having a proper understanding of the supply chain dimensions in the lean, agile and leagile patterns and (also) selection of improvement in the supply chain will not have appropriate efficiency and effectiveness. In this paper the relationship between type of selected supply chain (lean, agile and leagile) and life cycle of various products (standards, innovative, hybrid) was investigated. Finally I realized that the standard products in their entire life cycle require the lean supply chain while standard products in the two first stage of their life cycle (introduction and growth) require agile supply chain and in later stages (maturity and decline) require lean supply chain. Also hybrid or leagile patterns are appropriate patterns for hybrid products. As a general result it can be said that lean and agile supply chains are highly appropriate in to enhance management performance in turbulent market. Uncertainty in demand and variability in product is a point of distinction between lean and agile supply chain. For products that have short life cycles we should consider more sensitivity in analyzing appropriate type of chain because demands grow faster and will have more fluctuation. Thus, organizations may encounter greater risk for deficiencies in the early stages of product life cycles; and these deficiencies may create a false demand therefore potential customers may decrease. As a result, companies may face a huge inventory that their sale is declining. It should be noted that the manufacturing and construction facility in this situation may be abolished sooner than products with longer life cycle. As a general conclusion, matching features of supply chain and product is more important than its improvement in the future. Because the supply chain may not have sufficient time to improve itself and may only benefit from interesters related to short life cycle of the product.

REFERENCES

Agarwal A, Shankar R, Tiwari MK (2006). Modeling the metrics of lean, agile and leagile supply chain: An ANP-based approach. Eur. J. Oper. Res., 173: 211-225.

Bruce M, Daly L, Towers N (2004). Lean or agile: A solution for supply chain management in the textiles and clothing industry?, Int. J. Oper. Prod. Manage., 24 (2): 151-170.

Booth R. (1996). Agile manufacturing, Eng. Manage. J., pp.105-111.

Christopher M, Towill DR (2001). An integrated model for the design of agile supply chain. Int. J. Phys. Distrib. Logist. Manage., 31: 235-246.

Chan FTS, et al (2009). The relevance of outsourcing and leagile strategies in performance optimization of an integrated process planning and scheduling model. Int. J. Prod. Res., 47(1): 119-142.

Choi TY, Hong Y (2002). Unveiling the structure of supply network: case studies in Honda, Acura, and DaimlerChrysler. J. Oper Manage., 20: 469-493.

Chopra Sunil, Meindl Peter (2004). Supply Chain Management. 2 ed.

Upper Saddle River: Pearson Prentice Hall.
Chopra S, Meindl P (2007). Supply chain management: Strategy, Planning and Operation. Upper saddle River, New Jessey: Pearson.
Fawcet SE, Ellram LM, Ogden JA (2007). Supply Chain Management: From Vision to Implementation, Upper Saddle River, New Jersey: Prentice hall.
Gansler C, Luby RE Jr., Kornberg B (2004). Supply Chain Management in Government and Business, In Transforming Government in Gansler J, and Luby, JR. The IBM Centre for the Business for Government Series.
Gunasekaran A, Patel C, Tirtiroglu E (2001). Performance measures and metrics in a supply chain environment. Int. J. Oper. Prod. Manage., 21: 71-87.
Handfield RB, Monczka RM, Giunipero LC, Patterson JL (2009). Sourcing and supply chain management. 4th edition. Ontario: South Western.
Hugo WMJ, Badenhorst-Weiss JA, Van Biljon EHB (2004). Supply chain management: logistics in perspective. 3rd edition, Pretoria: Van Schaik.
Lee H, Billington C (1995). The Evolution of supply chain management models and paractive at Hewlett-packard. Interface, 25(5).
Marcus I (2010). Agile Supply Chain: strategy for competitive advantage. J. Global Strateg. Manage., 7 June, pp. 5-17.
Mason-Jones R, Naylor B, Towill DR (2000). Lean, agile or leagile? Matching your supply chain to the marketplace. Int. J. Prod. Res., 38(17): 4061-4070.
Naylor JB, Naim M, Berry D (1999). Leagility: integrating the lean and agile manufacturing paradigm in the total supply chain. Int. J. Prod. Econ., 62: 70-118.
Njoroge J (2009). Effects of the global financial crisis on corporate social responsibility in multinational companies in Kenya, Working paper, Covalence SA, Geneva.
Olhager J (2003). Strategic positioning of the order penetration point. Int. J. Prod. Econ., 85: 319-329.
Richards CW (1996). Agile manufacturing: beyond lean?, Pro. Invent. Man. J., 37: 60-64.
Sánchez A, M Pérez (2005). Supply Chain Flexibility and Firm Performance: A Conceptual Model and Empirical Study in the Automotive Industry. Int. J. Oper. Prod. Manage., 25(7): 681-700.
Samaranayake P (2005). A conceptual framework for supply chain management: a structural integration, Supply chain management. Int. J., 10(1): 47-59.
Sharifi H, Zhang Z (1999). A methodology for achieving agility in manufacturing organizations: An introduction. Int. J. Prod. Econ., 62: 7-22.
Tarofder AK, Marthandan G, Haque A (2010). Critical Factors for diffusion of web technologies for supply chain management functions: Malaysian perspective. Eur. J. Soc. Sci., 12 (3): 490-505.
Vonderembse M, Uppal M, Huang S, Dismukes J (2006). Designing supply chains: towards theory development. Int. J. Prod. Econ., 1000: 223-238.