

## **COMPARATIVE STUDY OF LEAN AND AGILE SUPPLY CHAIN MANAGEMENT ALONG WITH THE OPTIMAL MODEL PRESENTATION OF AGILE SUPPLY CHAIN MANAGEMENT**

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### **Abstract**

With the beginning 21st century manufacturing organization felt major and strongly changes about their. These changes will lead organizations to the challenges such as reduced product life cycle, minimum production cost and responding to diverse needs of customers that organizations for survival must be noted it until take minimum of loss and maximum of benefit from these changes. Factors such as technological advancement, globalization of markets, intense competition for customer acquisition has been lead to chaos and instability in the markets. These factors have caused that companies for their progress take assist supply chain management. Initially, this paper briefly explores to the concept lean production and agile then have been studied agile supply chain optimization models and agile and lean supply chain model is discussed and compared according to value of the customer's perspective, features and according to the type of product and the period of their life and also to points of their similarity and contrast referred to in the supply chain until framework is provide to help managers and decision makers in the supply chain.

Keywords: Supply Chain Management, Lean Supply Chain, Agility Supply Chain.

### **1- INTRODUCTION**

Today the Institute with severe challenges and competitive market pressures, including globalization, competition and cooperation, diversity of customer requirements and short product life cycle and supply chain are facing as a principle has been considered (Rezvani;Gilaninia,Mousavian,2011).Nowadays with the development field of competitive, commercial companies want that management strategy implement consistent with their supply chain. Supply chain is system where in it product manufacturers namely

suppliers of raw materials, production processes, product distributors and customers, by a material flow and information flow from one side are connected with each other (Stevens, 1989). In fact supply chain has been defined more widely and more proactively (Taleghani; Gilaninia, et al., 2011) a chain that all activities associated with the flow of goods and materials conversion include of stage of raw materials to final product delivery to consumers and its study is important that in the past, thought to remove all waste is the prevailing thinking in the production system but in nowadays volatile markets that changing needs of customers cause changing business environment. The need for a more flexible system is feeling until will match with changing market quickly. Studies in the field of comparing patterns of lean and agile have shown that supply chain performance in terms of customer value is calculated in terms of four dimensions of quality, price, delivery time, service level (Naylor et al., 1999). the concept of supply chain management (SCM) is a relatively new term in business management literature, but it is becoming increasingly important in the contemporary context of globalization (Gilaninia, 2011). From customer perspective dimensions of the supply chain is divided to two groups: market determined factor and market winning factors (Christopher & Towill, 2000). In studies (Vonderembse et al. (2006)) studied this issue in terms of product type, first products divided to Three categories included standard products, innovative and combinations.

## **2. THE CONCEPT OF LEAN**

Being lean means to create a value stream to eliminate all waste is including time, inventory or unnecessary costs and creates a production schedule (Naylor et al., 1999). In fact goal of lean production to achieve better results with less time and cost and in environments that demand is relatively stable and predictable and product diversity is relatively little, lean manufacturing concepts and techniques to better respond. Source of lean production can be attributed to Toyota Production System that focuses on reducing and eliminating waste. From the perspective of each of these systems factors of production, materials, human resources, parts, machinery and time be used more than required minimum amount and does not create added value for the product, called waste and must be removed (Christopher & Towill, 2000).

### **2.1. Lean Supply Chain**

Lean Supply Chain emphasizes on the use of continuous improvement activities that focus on eliminate all non-value added activities along the supply chain. Also reduce the time to set up machinery and also, enhances performance system production is an example of high importance. Because it causes economic production in small batches, reduce costs, increase profits and production flexibility. Although by reducing the startup time in lean supply chain is raising Flexibility within chain. Flexible and responsive to customer demand is important in the design, timing and distribution that in lean production is not much attention (Vonderembse et al., 2006).

## **3. THE CONCEPT OF AGILITY**

The word agile is used means the ability fast thinking with a clever method and in fact it is concept of maximum flexibility and an agile organization should be able to respond to possible changes that may occur in the organization. A lot definitions provided about agility, but in general we can say agility is responding to available challenges in business environment that this challenge is via change and uncertainty to the business environment. A key feature of agility organization is flexibility. In Table (1) is presented some common definitions of agility.

Table 1 - Some of the studies and the definitions of agility (Agarwal et al., 2007)

| Definition of agility |   |   |
|-----------------------|---|---|
| S.N.                  | Authors                                 | Definition of agility   |
| 1                     | Goldman, Nagel, & Preiss, 1995          | Agility means delivering value to customers, being ready for change, valuing human knowledge and skills, and forming virtual partnership.                                 |
| 2                     | Fliedner & Vokurka, 1997                | Agility is an ability to produce a broad range of low-cost, high quality products with short lead times in varying lot sizes, built to individual customer specification. |
| 3                     | Katayama & Bennett, 1999                | Agility relates to the interface between the company and the market.<br>Agility acts as a pillar to improve competitiveness and the business prospects.                   |
| 4                     | Christopher, 2000                       | Agility is defined as the ability of an organization to respond rapidly to changes in demand, both in terms of volume and variety.  |
| 5                     | Mason-Jones et al., 2000                | Agility means using market knowledge and virtual corporation to exploit profitable opportunities in a volatile market place.  |
| 6                     | Tolone, 2000                            | Agility implies effectively integrating supply chain and forging close and long term relationship with customers and suppliers.   |
| 7                     | Van Hoek, Harrison, & Christopher, 2001 | Agility is all about customer responsiveness and market turbulence and requires specific capabilities that can be achieved using 'lean thinking'.                         |
| 8                     | Aitken, Christopher, & Towill, 2002     | Agility is an ability to have visibility of demand, flexible and quick response and synchronized operations.  |
| 9                     | Stratton & Warburton, 2003              | Innovative products and unstable demand typify agile supply drivers.  |

In fact the main origin of "agility" as a concept in business and work is rooted in flexible manufacturing systems. At first was thought the path toward flexibility in production and manufacturing is move from automation towards create ability for rapid changes such as reducing the startup time and thus faster reaction to changes in product mix or volume. Soon after this theory about flexibility in the production was extended greater fields of business (Nagel & Dove, 1991).a organization for responding to changes occur in its business requires ability that called agility and is including speed, flexibility, competence and accountability.

### 3.1 agile supply chain

Agile supply chain includes companies which are legally separate but terms of operations are linked. Including these companies, suppliers, designers, manufacturers and distribution centers can be named. Companies by flow forward materials and feedback information flows are linked to each other; agile supply chain is focused on improving compliance and flexibility and have ability to respond and reaction quickly and effectively to changing markets (Lin CT et al., 2006). Christopher believes that an agile supply chain should include of distinguishing characteristics. These features can be seen in Figure 1. Also He is identified some of the features that supply chain should have as "very agile"(Christopher & Towill, 2000).

- Market sensitive – it is closely connected to end-user trends

- Virtual – it relies on shared information across all supply chain partners
- Network-based – it gains flexibility by using the strengths of specialist players
- Process aligned – it has a high degree of process interconnectivity between the network members

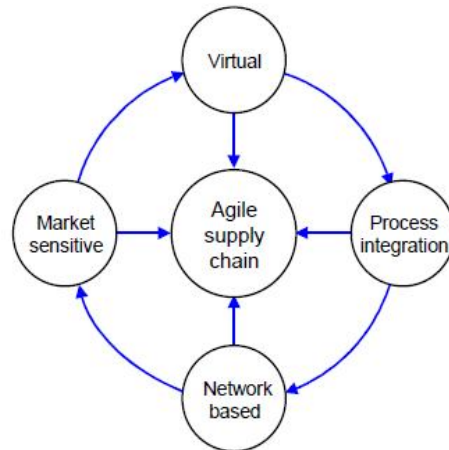
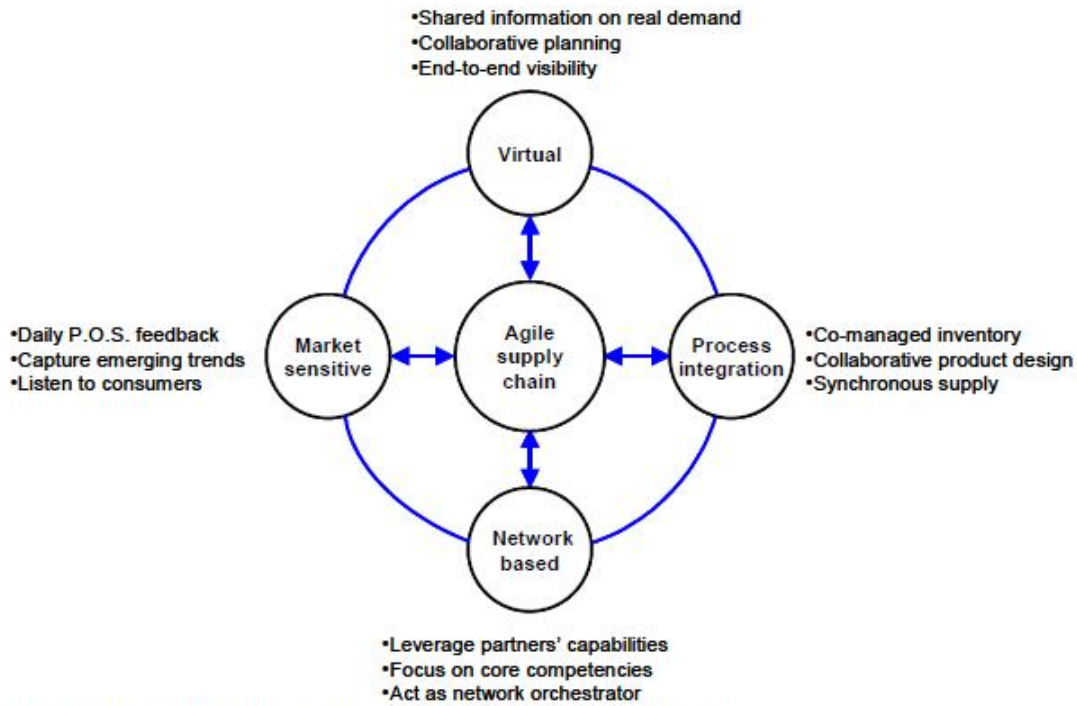


Figure 1) the agility supply chain

and agility optimal model is presented for the short life-cycle market. In figure 2



Based on the model originally developed by Harrison, Christopher & van Hoek (1999)

Figure 2) short life- cycle market (Christopher et al., 2004)

According to research by Christopher that obtained with holding meetings brainstorming among technical experts, First 27 variables as the main variables regarding has been extracted about agile supply chain that eventually with review and continue with these meetings was reduced to 15 variables. From this 15 variable be remembered as development variables Framework to improve supply chain agility (Agarwal et al., 2007)

- *Market sensitiveness (MS)*: Due to the sensitivity of the market, supply chain will have capability and capacity to respond to market real demand. Market sensitiveness of supply chain is influenced by level participation of partners and use of IT tools that enhances Participation and trust of partners and it causes motivates them in order to market information sharing and working with joint information.
- *Delivery speed (DS)*: Fast delivery means to deliver goods and services to customers faster than others competitors speed.
- *Data accuracy (DA)*: Data accuracy due to different people use about decision (inventory levels and demand forecasts)
- *New product introduction (NPI)*: Due to short period of product life cycle (3 years or less) new product introduction to market as an appropriate and successful will have numerous benefits for companies.
- *Centralized and collaborative planning (CCP)*: Centralized and collaborative planning with system approaches and create motivate in partners and suppliers cause reduced stock inventory levels, reducing preparation time, increase sales and improve service to customer.

- *Process integration (PI)*: Integration process is means Collaborative partnership between buyers and suppliers, Product development through participatory systems and information.
- *Use of IT tools (UIT)*: Use of IT tools has key and basic role in sharing and transfer of information. Of these tool can pointed to LAN & WAN internal network and Internet and email.
- *Lead time reduction (LTR)*: Lead time reduction indicate on duration use of delivery the product as competitive advantage. Time management and specifically lead time can be considered as competitive advantage that lead time reduction improves automatically quality, cost, productivity and creativity.
- *Service level improvement (SLI)*: Service level improvement will lead to improved supply chain management. For service level improvement, supply chain manager must increase capacity and ability service offered to customers as strategic.
- *Cost minimization (COM)*: Organizations must with review solutions and methods of their behavior and their suppliers take action to improve and reduce costs and supply chain managers must always seek ways with lower costs for their operations.
- *Customer satisfaction (CUS)*: The customer is central to all marketing activities (Gilaninia,et al, 2011).In fact customer satisfaction is customer renewed action to purchase services or goods consistent with their gained valuable in past experience. Todays, customer is basis trade and market approach and therefore supply chain must have a strategic view to field of customer satisfaction.
- *Quality improvement (QI)*: according to managers opinion, quality improvement in World-class is Success factor in global competition. They also stated that Supplier Cooperation and participation is essential in improving the quality and responsiveness to customer needs. To achieve this quality, develop relationships with suppliers are a good solution.
- *Minimizing uncertainty (MU)*: Due to the reduced space indefinite and potentially is important in order to function in international competition space.
- *Trust development (TD)*: Organizations for better interaction with their suppliers and supply chain performance must implement effective action in order to increase confidence and develop ways to its incremental.
- *Minimizing resistance to change (MRTC)*: Resistance to change is one of cases that always existed in organizations and must be taken optimal way to reduce its.

#### **4 .COMPARISON OF LEAN AND AGILE PATTERN**

Both agility and leanness demand high levels [of product quality. They also require minimum total lead-times defined as the time taken from a customer raising a request for a product or service until it is delivered. Total lead-time has to be minimized to enable agility, as demand is highly volatile and thus difficult to forecast. If a supply chain has long end-to-end lead-time then it will not be able to respond quickly enough to exploit marketplace demand. Furthermore effective engineering of cycle time reduction always leads to significant bottom line improvements in manufacturing costs and productivity (Towill, 1996). Lead-time needs to be minimized in lean manufacturing as by definition excess time is waste and leanness calls for the elimination of all waste. The essence of the difference between leanness and agility in terms of the total value provided to the customer is that service is the critical factor calling for agility

whilst cost, and hence the sales price, is clearly linked to leanness. However, whereas the Total Cycle Time Compression Paradigm (Towill, 1996), when effectively implemented, is a sufficient condition for achieving lean production, it is only one necessary condition for enabling agile supply. table 2 explains Comparison of lean supply with agile supply: the distinguishing attributes.

Table 2: Comparison of lean supply with agile supply: the distinguishing attributes (Mason-Jones et al, 2000)

| <b>Distinguishing attributes</b> | <b>Lean supply</b>    | <b>Agile supply</b>    |
|----------------------------------|-----------------------|------------------------|
| <b>Typical products</b>          | Commodities           | Fashion goods          |
| <b>Marketplace demand</b>        | Predictable           | Volatile               |
| <b>Product variety</b>           | Low                   | High                   |
| <b>Product life cycle</b>        | Long                  | Short                  |
| <b>Customer drivers</b>          | Cost                  | Availability           |
| <b>Profit margin</b>             | Low                   | High                   |
| <b>Dominant costs</b>            | Physical costs        | Marketability costs    |
| <b>Stockout penalties</b>        | Long term contractual | Immediate and volatile |
| <b>Purchasing policy</b>         | Buy goods             | Assign capacity        |
| <b>Information enrichment</b>    | Highly desirable      | Obligatory             |
| <b>Forecasting mechanism</b>     | Algorithmic           | Consultative           |

#### **4.1 .Comparison of lean and agile patterns Terms of customer value perspective**

Once in a supply chain to focus on final customer, many parameters are considered that can be summarized in the following four categories .Quality, price, delivery time and service level. In fact overall value is calculated as a product from a customer perspective (Naylor et al., 1999).

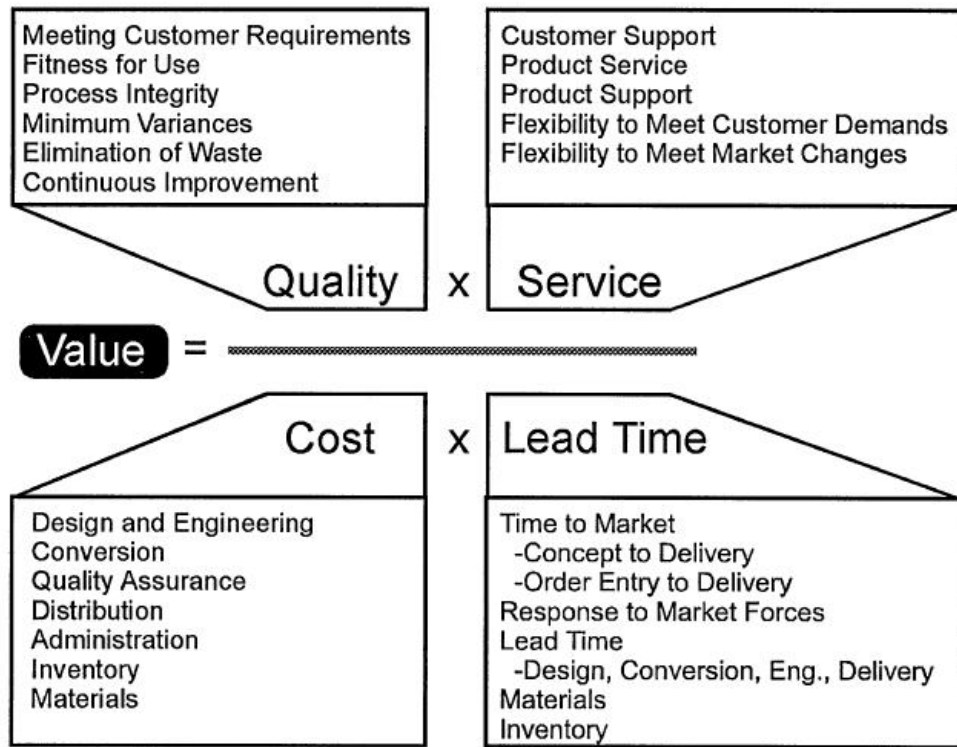


Figure3) Total value metric (Johansson et al., 1993)

Hill (1993) has earlier developed the concept of "order qualifiers" and "order winners" against which it is advocated that manufacturing strategy should be determined. Market order qualifiers are features that are considered necessary condition for entry into competition in every market societies. Order winners are features that are considered a necessary condition for winning and success in competition (Razmin & Serufori, 2007). Christopher (1997) has pointed out "it is supply chains that compete not companies". The connection between these ideas of "qualifiers" and "winners" and "lean" and "agile" is critical. At its simplest the lean paradigm is most powerful when the winning criterion is cost; however, when service and customer value enhancement are prime requirements for market winning then the likelihood is that agility will become the critical dimension (Christopher & Towill, 2000) At its simplest the lean paradigm is most powerful when the winning criterion is cost; however, when service and customer value enhancement are prime requirements for market winning then the likelihood is that agility will become the critical dimension.

## 4.2 Comparison of supply chain features in Characteristics of similar importance

Naylor key features of the lean and agile supply chain divided to 3 categories which is represents the essential, desirable and desired each of these features in the lean and agile supply chain (Naylor et al., 1999).

### 4.2.2 .similar features of importance in Characteristics of similar importance

*Eliminate muda:* Lean manufacturing is called lean as it uses less, or the minimum, of everything required to produce a product or perform a service. Leanness achieves this by eliminating all non-value



adding processes. However, in an agile system there will have to be a careful consideration of stock and/or capacity requirements to ensure the supply chain is robust to changes in the end users' requirements. The elimination of all non-value adding processes will inevitably reduce the cost of the product.

*Rapid reconfiguration:* Agile manufacturing means that the production process must be able to respond quickly to changes in information from the market. In lean manufacturing the ability to change products quickly is also key as any time wasted in changing over to a new product is muda and therefore should be eliminated. However there must be a certain amount of leeway with respect to the production schedule and the forewarning of product changes in order to eliminate muda.

#### *4.2.3 . Different features of importance in Characteristics of similar importance*

*Smooth demand and level scheduling:* Lean manufacturing avoids the requirement for robustness by calling for the demand to be stable through the use of market knowledge and information, and forward planning. However, if the end-user demand is beyond the control of the supply chain it will not be possible to implement lean manufacturing at the interface with the end-user. The paradigm that is pursued at any point in the supply chain will depend upon the requirements of the customer.

*Robustness:* An agile manufacturer must be able to withstand variations and disturbances and indeed must be in a position to take advantage of these fluctuations to maximize their profits. If a manufacturer needs to be as responsive as a truly agile manufacturer must be then it is inevitable that the demand for the product will not be stable. This is in direct contradiction with the next characteristic of a supply chain.

### **4.3 Comparing patterns of lean and agile supply chain based on its product type and life cycle**

There is another approach in this area is classified supply chain according to the type of product and life-cycle. This approach has been divided into the following three categories of products: (Vonderembse et al., 2006)

- *Standard products:* The market for standard products tends to be stable, and demand can be forecasted accurately. Standard products tend to have long life cycles where designs change incrementally. This ensures well-defined and predictable processes for product design and manufacturing. Manufacturer may find it useful to establish a long-term relationship with its suppliers for high quality materials, just-in-time delivery, and quantity discounts. With predictable demand patterns and consistent processes, cost minimization can be pursued very effectively, especially in the mature phase of the product life cycle. The characteristics of the LSC fit the needs of the standard product well.
- *Innovative product:* Innovative products are new products that require sophisticated design and/or manufacturing capabilities. They are significantly different from current products, and they often represent a breakthrough in product concept and design. They often satisfy emerging customer needs and in some cases needs that customers have yet to articulate. They usually command a premium price, which has the potential to increase profits. Innovative products generally have a shorter product life cycle than standard products. Once introduced and found to be successful, competitors quickly emulate innovative products because they command premium prices. As demand grows and competitors emerge, innovative product can become standard product where cost and quality are dominating characteristics. This forces the original manufacturer to constantly

interact with customers to generate new ideas that drive a steady stream of new and improved product types.

- *Hybrid product:* The hybrid product is a complex product that includes a mix of standard and innovative components. To respond, LSC and ASC are combined to provide the components needed in final assembly. The link with the final consumer of the hybrid products is based on the concept of agility. Hybrid products tend to have a long product life cycle with a certain degree of improvement or innovation offered periodically. These innovations most frequently occur at the module or component level. For example, in automobiles, fuel injector has replaced carburetors to increase fuel efficiency, and air bags have supplemented seat belts to improve safety. A critical decision for the manufacturer is often what to produce inside the company and what to buy from suppliers

## **5- CONCLUSION**

Nowadays, each of the lean and agile approaches is considered by many organizations. It should be noted that lean and agile production, each one holds its own advantages and strengths and weaknesses. Lean supply chain goal is responding to current demand with lowest prices while in agile supply chain flexibility, speed and innovation are important. It should be noted that these two are complementary. Namely can be said use of lean patterns is starting point for establishing in agile system. In this paper, we are trying that with provides definitions of lean and agile supply chain and presentation agile supply chain management optimal model and compare these two supply chain help to organizations to adopt the best choice in business environment and due to characteristics of their organization, nowadays and finally emphasis that Ideas developed in this area are requires an accuracy understanding of these two patterns, differences, their interventions and restrictions.

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