

Lean and Agile Supply Chain: Strategy for Increased Agility in Supply Chain Management

Tonga Yopa Christel Gabin, Sodonchimeg Erdenesuren

MBA (Supply Chain Management, Human Resource Management) Don Bosco University, Guwahati Assam 781017, India
School of Economics, Lanzhou University Lanzhou 730070 PR China

Abstract: *Through this research work we will be exploring some fundamental concepts of supply chain management while laying emphasis on the concept and agile and lean supply management and seeking to determine its importance in gaining a competitive advantage, today's market place is characterized by increased volatility, global competition, political environments subject to unexpected discontinuities. As such businesses must always seek to meet up with changes in demand volatility, improving on time delivery and shorter customer lead times. In order to survive companies need to respond to ever increasing level of volatility in demand and focus their efforts upon achieving greater agility, thus rapidly respond to changes in market and customer demands, as the bearer of competitive advantage. Companies today must therefore seek to design their supply chain to gain advantage by tackling issues of agility to stay competitive in the market place.*

Keywords: chain management, lean, agile supply management, 'leagile' agility

1. Introduction

With the rapid growth of globalization and uncertainties in the market place, the need for business to not only conceive but employ business strategies potent in giving comparative advantage in the market place becomes more and more crucial so as to sustain stable growth. The world is in the era of supply chain competition where organizations no longer act in isolation as an independent entity, but as a supply chain to create value delivery systems that are more responsive to fast changing markets, more consistent and reliable (Christopher, 2005:29; Pandey and Gaug, 2009:99) the core capabilities of a company lie in its ability to design and manage its supply chain in order to gain maximum advantage in the market where competitive forces are changing. New managerial practices and unique business models emerge and fade constantly as managers strive to help their companies succeed in this less kind less gently and less predictable world (Fawcett, Ell-ram and Ogden, 2007). The best word to describe the global market today is volatility. Organizations have to develop strategies in order to respond to ever increasing level of volatility in demand. The big question is how are supply chain executives coping with the changing business environment and what strategy can be implemented to achieve competitive advantage in their supply chain. Agility has the ability to respond to changes in the market and customer demands as the bearer of competitive advantage. Despite the obvious benefits of agility, organizations are faced with challenges in implementing the measures necessary to increase their agility. (Ismail and Sharifi, 2006)

1.1 Why supply chain management

This process referring to the interconnectivity of organizations working together through the products and services that they separately or jointly add value to in order to deliver them to the end customer. (Dawei.l. 2011)

The way of managing businesses have undergone profound changes, old business theories have been challenged and many new ideas have been created, supply chain management is undoubtedly one of those new and well grown management approaches emerged and rapidly developed across all industries around the world the earliest appearance of the term supply chain management as we know it today can be traced back to the early 1980s in the financial times describing the range of activities performed by the organization in procuring and managing supplies.. (Dawei l. 2011)

The survival of any business activity today is no longer dependent on its own ability to compete but rather on the ability to cooperate within the supply chain the seemingly independent relation between the organization within the supply chain becomes ever more interdependent. What's more practical and indeed more assured way of better managing a business is to manage it along with the supply chain through appropriate strategic positioning, adequate structural configuration, collaboration, integration and leadership. (Martin c 2011)

1.2 Defining supply chain management

Every product has its own unique supply chain and these can be both long and complicated. The supply chain for Cadbury starts with cocoa beans growing on farms and ends with the delivery of bars of chocolate to the customers, the supply chain for jeans starts with cotton growing on the fields and ends when you buy the jeans in a shop. (Nelly N 2004)

The supply chain describes the total journey of materials as they move from dirt to dirt, along this journey materials may move through raw materials suppliers and manufacturers, finishing operations logistics centers, warehouses, third party operators, transport companies, wholesalers, retailers and a whole range of other operations. Sometimes, the supply chain goes beyond the final customer to add recycling and re-use of materials. (Porter.me.1985).

1.3 Fundamentals of supply chain management

Any supply chain management practice and activities is captured by the three conceptual components: supply chain configuration; supply chain relationship; and supply chain coordination

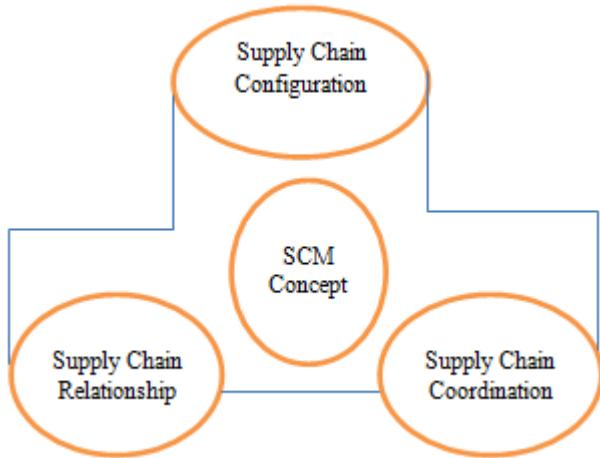


Figure 1: Supply chain management conceptual model
Source: fundamental of supply chain management, Dawei l 2011

- Supply chain configuration, is about how supply chain is constructed from all its participating firms. It also includes how big the base for the OEM how wide or narrow is the extent of vertical integration, how the downstream distribution channel is designed, it is also known as supply chain architecture. The decision on supply chain configuration is strategic and at a higher level.
- Supply chain relationship, it's about the interfirm relationship across the supply chain the key focus of the relationship is often around OEM and its first tier suppliers and first tiers consumers and the relationship between. The type and level of the relationship is determined by the contents of the inter-organizational exchanges. The relationship is likely to be arm's length if they only exchanged the volume and the price of the

transaction; on the other hand, the relationship would be regarded as a close partnership if the parties exchanged their vision, investment planning and detailed financial information, the decision on supply chain relationship is both strategic and operational. (handfed 2002).

- Refers mainly to the inter firm operational coordination within the supply chain. It involves the coordination of continuous material flows from the suppliers to the buyers and through to the end consumer in a preferably JIM manner. Inventory management throughout the supply chain could be a key focal point for the coordination. Production capacity, forecasting, manufacturing scheduling, even customer services will all constitute the main contents of the coordination activities in the supply chain decision. The decision on the supply chain coordination tends to be operational.(Dawei l 2011)

1.4 Structure of the supply chain

A simple view of the supply chain will be a single product moving through a series of organizations, each of which somehow adds value to the product. Taking one organizations point of view, activities in from it of it moving materials inwards are called upstream; those after the organization moving materials outwards are called downstream.(cooper, mc 1997)

The upstream activities are divided into tiers of suppliers. A supplier that sends materials directly to the operations is a first tier supplier; one that sends materials to the first tier supplier is a second tier supplier; one that sends materials to a second tier supplier is a third tier supplier; andis on back to the original sources. Customers are also divided into tier one that gets a product from directly from the operations is a first tier customer; one that gets a product from a first tier customer is a second tier customer and so on to the final customer. (Donald .w 2003)

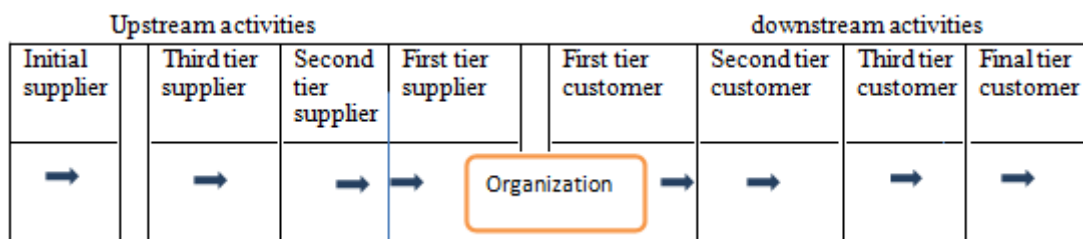


Figure 1.2: Activities in a supply chain
Source: Donald w 2003, logistics an introduction to supply chain

It is fairly easy to imagine the shape of a manufacturers supply chain, but most other organizations use the same general approach. Airlines, for example, move passengers from pick-up points, through local feeder services to major hub airports on to another but and then back out through local services to their destinations banks correct all cheques in central in clearing houses before sending them back to branches and customers; blood transfusion services have original clearing houses before sending them back to branches and customers; blood transfusion services have

regional centers that act as wholesalers for plasma. (Donald .w 2003)

Each product has its own supply chain, and there are a huge number of different configurations some are very short and simple- such as a cook buying potatoes directly from a farmer. Others are surprisingly long and complicated. An everyday product like a shirt has a long journey from the farm growing cotton through the final customer. It also has several chains merging as buttons, polyester, dyes and other materials join the main process. In the same way, when you

buy a computer many strands of the supply chain merge as intel provide the processor, Matshita the DVD drive, Agfa the scanner, Hewlett-packard the printer Microsoft the operating system and so on. (Manfred k 2006).

Supply chains diverge to meet demand from different types of customer manufacturers of car components, for example, sell some products to car assembly plants, some to wholesalers, for garages doing repairs, some to retail shops for individual customers and some directly to customers through websites. Then the supply chain divides into separate strands with the same product following alternative routes.

As you can see, our picture of supply chain is getting more complicated with various mergers and divisions along their length. The reality is even more complex, as each organization works with many often thousands of different products each

1.5 Evolution, changes and shift in supply chain management

Supply chain management is a global activity and process. Manufacturers and customers are worldwide, the three biggest trade lanes are intra-Asia, Asia-North America and Asia-Europe much of that global volume involves china, as an exporter to other countries and an importer to feed its manufacturing and consumer needs.

Customers/sales- developing and less developed economies and markets. Sales growth is tied to expanding into new customers and markets. Companies in mature markets look at selling into other countries as an important way to grow. This need for selling applies to more than multinational corporations. The approach has strategic implications for the company and for supply chain management.(Tony f 1999).

The potential of emerging markets is estimated in the trillions dollars. There are many developed and developing countries. The BRIC Brazil, Russia, India and china are identified as key developing economies, each has significant opportunity and each has geographical diversity with both large and midsize cities. Customers in developed countries continue to want more products, this is both expansion and a fragmentation. In developing countries, the consumer population will continue to grow.

How to service these from a supply chain view is important. How many additional products will be developed? Where do firms locate supply chain operations, in what countries, city or cities? How do companies develop agile, responsive supply chains to handle the expanding list of products?What is required to operate in these places? Can a company implement from its existing supply chain model approach, and what must be modified to adapt to local conditions, in most cases companies will need to change their supply chain practices to do business and to service markets, including incorporating local service providers. (Nubia n 2012)

1.6 manufacturing-globalization or deglobalization

Transitioning to onshore or nearshore would mean investing in factories and equipment. It can improve supply chain operations and costs. Shorter supply chains aid planning, reduce the working capital tied up with inventories and improve service, whether it means delivery to shore shelves or to customers warehouses. (Dan d 2007)

The reality is industrial production/manufacturing and in turn, sourcing –is global as with sales. It will expand into other areas. Low cost manufacturing is important to having competitively priced consumer products to sell worldwide. Other industries have different manufacturing needs.

Depending on the type of manufacturing and industry, manufacturing should often be close to raw materials or to markets. Location of factories is then the need. Depending on how developed the economy of a country is, the logistics infrastructure may create challenges, as with global sales. Infrastructure begins with ports and airports. This can apply to whether the products move dry bulk, tankers, reefer, general cargo, roll on/roll off, or container, either way, logistics is impacted as to increased complexity and to global scope.

1.7 Ecommerce

Online selling is for all providers of products, whether they are manufacturers, wholesalers, distributors, or retailers. Many of these enterprises may be startups run by entrepreneurs who will take more risks than will their large counterparts. In addition to diverse markets and countries. It expands firms into additional multichannel selling with different service requirements. Ecommerce will be truly global. It will mean selling to consumers or businesses located anywhere in the world. It could require a blended global supply chain with shipping orders for many different products from warehouses located in key country locations and shipping orders directly from suppliers located worldwide to end customers.

1.8 logistics service providers

Logistics providers will need to adapt to the global changes as to additional geographic cover age and services to meet the new demands. This may mean partnership or combining services between global and local providers. Economies of scale that have come to be expected with ships, warehouses or other primarily fixed cost areas may be difficult to achieve in certain areas.

2. Lean Supply Management

The term “lean” was first coined in the large scale research program called IMVP(international motor Vehicle Program) initiated by MIT(Massachusetts institute of technology). The primary concern of the program was the unanticipated yet strong competitive advantages of Japanese automotive industry over that of Americas and Europeans. The key findings of the program have been published in many books and articles.(Zain b 2018)

Lean manufacturing is a comprehensive production management system developed in Toyota originally but later gradually refined and improved by many scholars and practitioners around the world. There are two major features of lean manufacturing that distinguishes it from mass production are first, increased efficiency through the reduction of waste and error. And second reduced carrying cost of inventories by manufacturing in small batches. The key ingredient to success of the system is japan's highly skilled workforce. The overriding concept of the lean system is about doing more with less.(Dawei .l 2011)

A philosophy for identifying and removing waste across the whole business activities. It is also about adding value for the customer and the business and it is customer driven.

Lean manufacturing focus on the add value from demand, the whole production system is basically pulled from the demand rather than entirely depend on forecasting based scheduled production. Product customization and increased scope of customer choices are the direct results. Lean manufacturing develop and make use of employee's intellectual assets. Everyone is encouraging d to make improvement suggestions and even have the power to stop the assembly line if they see something wrong. High commitment, hardworking, well educated workforce and loyalty to the company become part of the organizational culture.

Lean manufacturing emphasizes the optimization across organizations and supply bases not just the functional silos. It promotes close partnership relations with the first tier suppliers and other strategic partners in the distribution channel. It created the tiered supply base structure. The waste between the organizations, often ignored in the past, has been identified as key improvement area. The modular design of the automobile has been master minded to fit the tiered supply management.

2.1 lean supply principles

To understand what's unique about lean supply and how it works, one must first examine the supply chain practice in mass production, knowing the whole lean manufacturing system was originally evolved from inherited mass production system. In the mass production supply system, the mass producer buys its basic components from a large supply base. The supplier number will normally reach 5000 to 8000, bearing in mind that a modern automobile will have more than 20,000 basic components built into it. As shown in the figure below the mass structure is very flat. The mass producer takes on the assembly of the whole vehicle as well as many subsystems and modules. Thus the level of outsourcing is relatively Low

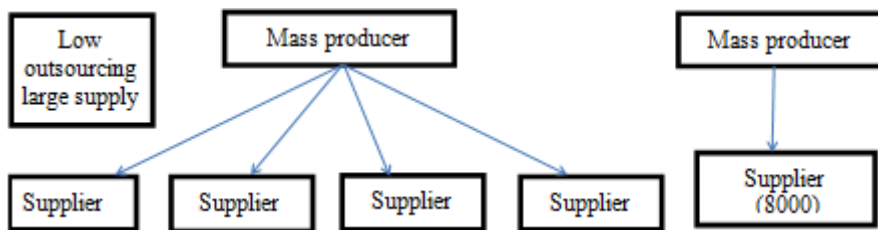


Figure 3: Mass supply chain structure
Source: conspect journal, lean supply chain management.

The mass producer will design the parts to be made by the supplier. The process is basically a sequence of one step a time from design, bid, prototype, check, contract and make with this system, when it comes to find and select the supplier, the cost will always come first. Whosever can make the same part a lower price will win the bid. This will often lead to a scenario that the supplier will quote a low price to win the bid then expecting to raise the price through the annual price adjustment. Suppliers will hardly share nay information with the buyer other than the volume and price. (Dawei .l 2011)

The consequences of the mass supply system are far from beneficial. Supplier brought into the production too late that even the suppliers have better ideas on the design of the vehicle anyway. Intense cost pressure from the buyer to supplier are detrimental that the buyer often play-off the suppliers making them reluctant to share production information. This also made it impossible for the buyer to estimate the true cost of making the parts. When the supplier has improved the production efficiency there is no incentive to merge the learning curve. All these resulted in high parts cost and unsatisfactory quality

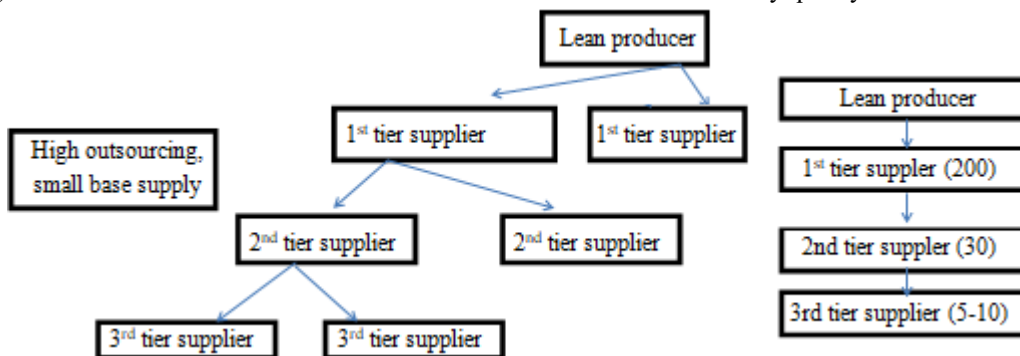


Figure 4: Lean supply structure
Source: fundamentals of supply chain Dawei l 2011

Over the years the Japanese developed a set of completely different practices known as the lean system as show on the figure above the can be summarized in a number of principles that are in stark contrast with what the mass supply system was about, these principles include the following

- Supply from a small 1st tier supply base: the lean producer also use large number of supplier, but it manages them in a tiered structure. The suppliers directly supply the buyer is called the first tier supplier. It is this group of first tier suppliers that the lean producer now deals with directly and gets all the supply of subsystems and modules and components from. Hence the first tier suppliers group is called the supply base. The number of suppliers in the supply base for the lean structure is about 200 to 300.
- Develop appropriate usually close partnership: by using a much smaller supply base, the lean producer can manage to spare more time and other resources to interact with each and every one of the first tier suppliers. This has made it possible for the operational relationship between the buyer and the suppliers to become close. The close partnership will typically entail the shared vision and mission, joint design and development of new products strategically collaborate capital investment planning, capacity synchronization, and coordination on jit delivery and inventory optimization the contractual term for the suppliers are normally form medium to long term
- Supplier selection based on performance: when the lean producer selects its supplier, price is no longer the only criterion, nor the most important criterion like what mass producer will do. Lean producer will base its ranking and selection on a number of higher level performance focused criteria, such as quality standard r&d capability, delivery reliability management system and standard, commitment and relationship. Price will also be considered as one of the criteria, but it will always be referenced to the value that the company can offer.
- Single and dual sourcing only: lean producer tends to prefer the single sourcing or dual sourcing strategy not multiple sourcing single sourcing mean the lean produce will source the product form only one supplier. This means there is no back up suppliers and no duplicated suppliers for the same product. Compare with the multiple sourcing strategies, single sourcing has a number of key advantages. It consolidates the volume to one supplier so that the unit cost can be minimized. The supplier will reap the benefit of economy of scale, it provides the convenience and focus when research and product development is required to deal with two different companies for the same product design and raise unnecessary complications.
- 'Market price minus' rather than 'supplier cost plus: lean supply chain deals with the pricing issue very differently. In mass supply system, the supplied component price is normally determined by the unit cost of making the component by the supplier plus the profit margin that the supplier needs to make, that is what's called supplier cost plus margin. The problem with this approach is that the suppliers cost model is accepted without questioning. The uncompetitive supplier cost could slip into the supply chain and compromises the supply chain competitiveness. Lean producer use the market price minus approach. It first determine the market price of the supplier component through market research and benchmarking, then take away minus the agreed reasonable profit margin that the supplier need to make on each unit; what's left is the target cost if the target cost is lower than the supplier actual cost , the buyer and the supplier will then work together to lower the cost to meet the target cost.
- Early and close engagement with suppliers for npi(new product introduction) the buyer and the suppliers job is simply to make it according to the blueprint given, the supplier has no involvement in the design stage. Lean supply system chooses to identify its suppliers first and then get them involved in the design planning stage for the new product introduction. This way the suppliers will have plenty opportunities to contribute their expertise to the design and by working with the engineer from the buyer innovation and new ideas can be generated much more effectively. The engineers form the supplier may work in the buyers' site as the residential engineer as if they are the same company.
- Synchronized flexible capacity: in the lean supply system, the assigned capacity for both supplier and buyers are not permanently fixed because a fixed capacity will either be over capacitated when the demand is low or it will be under capacitated when the demand is high more importantly the capacities of the supply chain efficiency lean supply system build on a largely synchronized flexible capacity. The key is to have the flexible capacity at each link of the supply chain. The capability flexibility means have the ability to rapidly increase or decrease production levels or to shift production capacity quickly from one products or service to another.
- Just in time delivery: this is a well-known lean approach. It represents the key philosophy and characteristics of lean manufacturing and lean supply chain. Jit is an approach to material control based on the view that a process should operate only when a customer signals a need for more parts form heat process. When a process is operated in the jit way, goods are produced and delivered just in time to the built into the subassemblies. Through the supply network the trigger to start work is governed by demand from the customer.
- Incentive and reward alignment: lean supply chain pays great attention on the alignment with the suppliers through incentive and reward. The objective of the lean producer as the buyer is not to take piece of profit form the supplier. But to work with the supplier to get the cost down so that together they build stronger supply chain, the contribution that supplier made to the cost reduction will be rewarded incentivized. The typical practice sis that when the supplier made x amount of saving through efficiency improvement 50%of each will be retrained by the supplier rather than become the cost cutting of the component of the buyer. Contributions on better design and quality improvement will be rewarded with more business.
- Willingness to share a substantial part of its proprietary information: lean supply chain also represents a culture of mutual trust loyalty at least and usually within the supply chain. Suppliers are willing to share substantial amount of proprietary information with the buyer. This openness and rust not only makes the supply chain much more visible, thus easy to coordinate, but more importantly it creates synergy between the parties. The value of information increases when it is shared and made use of more widely. (bryan m 2013)

2.3 Agile supply management

Agile management consists of carrying out the activities connected to strategy of diversification to deliver the product, the consumer cannot find elsewhere. The quick response to changes in the demand is most important. This activity in logistics operations involves the use of flexible and agile operations to provide an excellent service level of final customers, it could be measured as the ratio of products delivered to ordered, the quality of mistakes made during the sorting process, the ability to cancel the orders. The percentage of orders fulfilled in 100% in accordance with requirements, the size of damage, price reduction due to failure to meet delivery times, easiness to prepare the goods in accordance with order, etc. this strategy allows reacting to unforeseen events such as short delivery delay, changes in demands as well as natural disasters. The agility is especially important when product life cycles become shorter, market demands change more rapidly and the demand becomes more sensitive. It is also the best way to satisfy more demanding clients because of a lower risk of unsatisfying of the customers, lower risk of lost orders and too slow response however the agility has its own risks e.g. it needs the free space to secure the flexibility of the operations and it causes the reduction of the productivity (Emmansomanson 2011)

Source: m.lfisher, 2005, mason-jones, Rachel, James B, Denis R, Towill, 2000

Lean and agile management are simultaneously opposing and complement and therefore recently the hybrid concept of supply chain adopted to use. The hybrid concept is called "leagile" Christopher, Towill 2011 or "league" Goldsby, Frifis, Raath 2006 the classification of the hybrid concept can be performed according to products, the demand type and the type of the postponement in the case the Pareto principle (80/20) is used to divide the product into groups manufactured in accordance with lean management (20% assortment items, make to stock production, central stock management, use the benefit of scale effect) and the agile management (20% of assortment items, make to order production, the usage of a quick response for the demand). The second approach takes into consideration the nature of demand. The lean concept can be successfully used in case of the stable demand. It enables to increase the productivity of operations by applying a continuous flow. In the case when the demand changes due to promotional or seasonal periods, the concept of the agile management is the better solution. The third approach refers to issues of the delay and the customization. The concept of lean management is used for basic unfinished products until they reach the decoupling point. The concept of agile management is used for part of the chain after the decoupling point. In the process of the product utilization, which is adding the characteristic elements to the base form of the product for the specific order? The decoupling point is a border between two options. The first one is the model based on forecasting. The make to stock production strategy. Used for standardized product (Sylwia K 2010)

Table 1: Table characteristics of lean and agile supply chain in strategic aspect

Supply chain characteristics	LEAN	AGILIE
Superior objective	Meet the foreseeable demand in the most efficient and therefore cheapest way	Respond quickly to changes in demand in order to reduce the shortage of supply, price reduction and obsolescence of goods
Market success factors	Quality delivery time availability	Quality cost total delivery time
The most important element of competitive advantage	Cost	Availability
The strategy in orders area	To shorten the cycle of the fulfillment of the orders and if it is possible, without increasing cost	Boldly invest in methods to rescue the cycle of the fulfillment of the orders
Suppliers selection strategy	The superior criteria for selection should be the price and quality	The superior criteria for selection should be speed, flexibility and quality
Stocks keeping strategy	To shorten the cycle of the inventory rotation and to minimize the stock level in whole supply chain	To allocate the important buffer stock of semi- and final products
Strategy in the area of product designing	To design products regarding the cost reduction and increasing the production productivity	To use the modular designing to postpone the phase of the diversification of the product
Production strategy	To keep high level of production capacity utilization	to keep the surplus of buffer production capacity

3. Conclusion

Supply chain management has become a crucial aspect of today's globalized economy its growth is proportional to the growth in sales, sourcing and manufacturing, logistics service to support the worldwide dynamics will change, all driven by the expanded complex dynamics of global supply chain management, through our research work our objective has been to determine the link between lean and agile supply chain and competitive advantage. Based on the literature explored because agile supply chain is a winning strategy for growth and lean supply chain is a prerequisite for the creation of an agile supply chain, it is evident that it is a strategy for competitive advantage agile supply chain is triggered by change which is the only constant thing in the business environment, effective coordination of all participants across the supply chain is a crucial determinant of success. Reducing the product life cycle and reducing the product cost as supply fluctuates more rapidly than ever before. Putting the idea of lean and agile supply chain together, it can be concluded that lean is needed to build agility and the prerequisite for success in the market place is an agile supply chain. The key to the success of an organization is to align agile supply chain strategy to the differentiation strategy to meet the overall objective for competitive performance, hence competitive advantage; therefore agile supply chain is a strategy for competitive advantage. If you are not agile, you can't do it, because customer expectations are never static.

References

- [1] Christopher, M. and Towill, D.R., (2000), "Supply Chain Migration from Lean and Functional to Agile and Customised", Int. Jnl <https://www.researchgate.net>
- [2] Fisher, M., (1997), "What is the Right Supply Chain for your Product?", Harvard Business Review, Ismail, HS and Sharifi, H. (2006), A balanced approach to building agile supply chains, International Journal of Physical Distribution and Logistics Management, <https://www.emeraldinsight.com>
- [3] Daweilu 2011 fundamentals of supply chain management ,ventus publishing APS
- [4] MARTIN C 2011 logistics and supply chain management 4th edition financial times imprint of pearson
- [5] Nelly nailatie m 2004 the power of marketing, panerbitsalemaempat
- [6] Porter , ME 1985 competitive advantage free press, new York.
- [7] Handfred and Nichols 2002 supply chain redesign, patience hall.
- [8] Cooper, MC 1997 logistics and supply chain, <https://www.macmillanihe.com>
- [9] Donalwalter 2003 logistics an introduction to supply chain palgravemacmillan, new York 175th avenue.
- [10] Manfred kraff. 2006 retailing in the 21st century, Heidelberg Germany.
- [11] Ltd management 2018 logistics, supply chain management evolution changes and shift <https://www.itdmgmt.com>.
- [12] Tony frost 1999 , competing with giants survival strategies for local companies in emerging markets , <https://hb.org>
- [13] Nubia nieto 2012 the influence of emerging economies in international affairs, etudosavancados, sao polo brazil
- [14] Dan Dempsey 2007 , benefit of supply chain management <https://www.liason.com>
- [15] Zainbooks2018 lean supply management lean manufacturing , <https://www.zainbooks.com>
- [16] Conspect journal 2017 lean supply chain management <https://conspecte.com>
- [17] Bryan matindikanuki 2013 role of lean manufacturing in organization competitiveness, <https://citererx.ist.psu.edu>.
- [18] William crane, 2017 supply base optimization 4 steps to ensure success, <https://www.industrystarssolution.com>.
- [19] John buzacolt 2008, flexibility in manufacturing and services achievement insights and challenges, springer verlog.
- [20] Charite2011lean manufacturing <https://www.ncbi.nlm.nih.gov>
- [21] Sylvia konecka2010 lean and agile supply chain management in the aspect of risk management.
- [22] Emmansonemanson 2011 purchasing and supply chain management, <https://emmansoneme.wordpress.com>.
- [23] m.l fisher,2005lean and agile supply chain management concepts in the aspect of risk management <http://www.logforum.net>