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IDENTIFICATION OF CRITICAL SUCCESS FACTORS FOR LEAGILE MANUFACTURING INDUSTRIES

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Abstract

Now a days leagile manufacturing has become one of the powerful manufacturing strategy for organizations to gain a competitive advantage in global market. Lean as well as agile manufacturing features are considered in leagile manufacturing system. Lean manufacturing concept tries to eliminates the all the wastes like over production, inventory, waiting, defects etc. while agile manufacturing concept enables the organization to react and pro-react to random and diversified market changes while minimizing the modifications to the company's main structure by establishing an intimate commercial relationship between customers and suppliers. Lean manufacturing tries on no inventory and try to execute Just in Time methodology but in agile manufacturing, as soon as customer order is achieved, production should be started, this is only possible when there is some inventory in the store to start the production. The market is excessively modest, so there is a compulsion for the companies to implement latest and current technologies with modern equipment's. Therefore, implementation of leagile manufacturing system become popular so the main aim of this paper is to find and explain the importance of critical success factors (CSF) affecting leagile manufacturing system with the help of literature review and in discussion of academicians employed in concerned field.

Keywords: *Lean manufacturing, Agile manufacturing, Leagile manufacturing, Critical success factor (CSF).*

1. INTRODUCTION & LITERATURE REVIEW

LEAN MANUFACTURING

The idea of lean manufacturing was introduced in Japan, and the Toyota production system was the first to practice lean manufacturing. Lean manufacturing ideas are mainly raised from the Japanese manufacturing industry. It was initially coined in article, "Triumph of Lean Production System" by John Krafcik in 1988. A comprehensive historical explanation of the IMVP and in what way the term "lean" was introduced is given by Holweg (2007).

Lean is worried about wide range of wastes which don't increase the value of the item. Lean manufacturing is a planned method for waste minimization (Muda), overload (Muri), imbalance (Mura) in a manufacturing system. Lean manufacturing system helps in differentiation and removal of waste. As waste is removed quality advances while manufacturing time and cost are reduced. A list of lean tools would comprise of: SMED (Single Minute Exchange of Die), VSM (value stream mapping), 5S, Kanban, poka-yoke, TPM (total productive maintenance), jidoka, kaizen etc.

Lean tool techniques when shared with SWOT (strength, weakness, opportunity, threats) analysis help in eradicating wastes within the organization (Upadhye, Deshmukh, & Garg, 2010). Lean manufacturing when executed effectively results in a growth of outputs, a decrease in inventory and work in process (Seth & Gupta, 2005). The final goal of a lean manufacturing system is to eradicate all wastes from the organization. A lean system is characterized by two pillars: the first is 'jidoka' and the second is 'just-in-time'. A lean manufacturing system mainly focus on to give products of advanced quality at the lowermost likely cost and in minimum time by removing wastes (Dennis, 2007).

AGILE MANUFACTURING

Initially a forum under the title of "Agile Manufacturing Enterprise Forum (AMEF)" was formed in Iacocca Institute at the Lehigh University that finally led to the overview of the Agile Manufacturing (AM) concept (Sanchez et all, 2010). This idea enables the organizations to react and pro-act to the erratic and diversified market changes while diminishing the modifications to the company's main structure by creating an intimate commercial relationship with the suppliers and the customers.

Agility is a scientific term which means responsiveness. Thus, agility is the term used in an organization that has developed the parameters and the tools to make it respond quickly and effectively to customer demands and market variations while still being cost efficient and quality viable. It is the ability to manage ongoing, rapid and sustainable change so that the organization can respond to fast moving environment changes. It is supportive so that the business can flourish in the odd times. Agility is helpful in environment where predictability is less and the variation between volume and variability is very high.

In other words, Agility means an enterprise wide response to a progressively competitive and fluctuating business atmosphere, totally based on four basic principles: customer gratification; rapid adaptation or exchange of the equipment; practice of human resources and collaboration for the competition (Gunasekaran, 2001). Yusuf et al., (1999) defined that "the agile manufacturing system integrates complete variety of flexible production technologies, along with directions cultured from total quality management (TQM), just-in-time (JIT) and lean manufacturing system."

1.1 LEAGILE MANUFACTURING

In modern market lean and agile manufacturing concepts are gaining popularity day by day but the achievement of firms rests on customers' satisfaction and right cost management with minimizing the wastes. Lean and agile principles have attracted considerable interest in the past few decades. Industrial sectors throughout the world are upgrading to these principles to enhance their performance, since they have been proven to be inefficient in handling some of the holistic situations. Therefore the present market trend demands a more robust strategy incorporating the salient features of both lean and agile principles. Inspired by these, the leagile manufacturing has emerged, encapsulating both lean and agile features. Based on supply chain frameworks, effectively merging leanness and agility became the primary concern, and the new concept ''leagility'' was proposed (Huang Yu-Ying et al., 2009). Mason-Jones et al. (2009) projected a leagile model in which the lean and agile systems work at different points in a manufacturing supply chain. This model is based on a ''decoupling point'', which splits lean processes from agile processes in manufacturing supply chain.

Due to intense competition and globalization industries are trying to make quality, reliable product and provide them in shortest possible time. This is achieved by implementation of Leagile Manufacturing in the industries.

Leagile is grouping of both system i.e. lean and agile. Lean is mainly focuses on less of everything (material, time, manpower, space etc.) to produce the product while agile focus on customer requirements and reconfigure system as early as possible without any delay. In short, Leagile manufacturing system emphasizes on diminishing the wastes and meeting customer's requirement in smallest likely time.

CRITICAL SUCCESS FACTORS

A number of authors have given the definition of critical success factors from different perspectives which are given below:

According to Rockert (1979), "CSFs as the limited figure of zones in which outcomes, if they are satisfactory, will ensure successful modest performance for the association."Critical success factors are crucial to the achievement of a program, and if objectives associated with these factors are not attained, application program will also lead to failure. According to Boynton and Zmud (1984), "CSFs are "those rare things that must go well to confirm success." According to Brotherton and Shaw (1996), "The CSFs are the actions and processes that can be controlled by the staff to achieve the organization's goals". According to Coronado and Antony (2002), "If CSFs are not underlined, not only there could be a noteworthy variance in the success gained, but also losses in terms the effort, time and money."

In the context of leagile manufacturing, CSFs represent the crucial elements without which the execution stands little chance of success.

2. IDENTIFICATIONS OF CSF'S AFFECTING LEAGILE MANUFACTURING SYSTEM

Several factors influencing leagile manufacturing system have been distinguished through literature review. These are recorded in Table I.

TABLE I
CSF'S AFFECTING LEAGILE MANUFACTURING SYSTEM

S.NO.	Critical Success Factor (CSF'S)	References
1	Concurrent Engineering	[9]
2	Virtual Enterprise	[4], [5], [17], [48]
3	Rapid Reconfiguration	[20], [24]
4	Advance manufacturing technologies	[1], [13], [33], [37]
5	Quality tool and techniques	[22]
6	Supply chain Management	[9], [32], [28], [10], [20], [30], [46], [44], [18], [34], [25], [39], [36], [47], [3]
7	Use of Information Technology	[14], [17]
8	Web-Enabled Technologies and Services	[27]
9	Total Quality Management	[21]
10	Human Resource Management	[40], [12], [43], [24], [29], [31]
11	Strategic Management	[2], [5]

3. EXPLANATION OF CSF'S AFFECTING LEAGILE MANUFACTURING SYSTEM

According to demand manufacturing changes, when demand is volatile agile system is preferred while in stable demand lean system is preferred. Therefore, in some cases it is worthwhile to use a different paradigm, called leagile manufacturing which accounts the benefits of both lean as well as agile.

1. **Concurrent Engineering:** CE, also known as simultaneous engineering, is a key enabler for agile manufacturing. In CE different stages run simultaneously, rather than consecutively for designing and developing products. Agility in manufacturing requires a change around the formation of product development teams, and managing change in an industrialized environment requires a more efficient method of concurrently designing both the manufactured goods and the downstream processes for production and support. This systematic approach is fundamentally known as CE (Gunasekaran, 1999). It decreases product development time and also the time to market, leading to improved productivity and reduced costs which is overall beneficial from leagile manufacturing.

2. **Virtual Enterprise:** The model of Yusuf et al, (1999) recognizes the relationship of agile manufacturing and virtual enterprise. A short-term collaboration to the different suppliers of an enterprise is known as virtual enterprise. According to Elkin et. al, (2004) a virtual organization is the integration of core competencies distributed among a number carefully chosen but real organizations all with similar supply chain focusing on quick to market, cost reduction and quality. It is essential to develop VE in a more productive way by reducing the time and cost as well as delivering goods/services in a competitive manner in global markets. For taking the advantages like reducing time and cost makes virtual enterprise as pivotal factor for leagile manufacturing.

3. **Rapid Reconfiguration:** Each manufacturing system has a certain level of agility. This refers to the effort with which capabilities can be reconfigured to produce different varieties of products. Once a highly agile system is acquired, reconfiguring it to produce different types of products can take place with either less time or less cost. Figure1 shows the effect of agility on reconfiguration cost and

reconfiguration time, assuming simple linear relationships. Spending an amount C1 allows the less-agile system to be reconfigured in T2 time units and the more-agile system in T1 time units, T1 < T2. On the other hand, both systems can be reconfigured for the same amount of time, but the cost will be higher for the less-agile system. For example, reconfiguring in T2 time unit's costs C1 for the less agile system and C2 (less costly) for the more agile system.

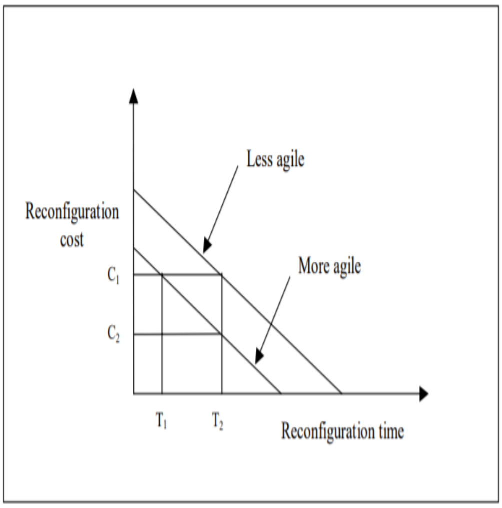

Fig.1 Two systems with different level of agility

Decision variables related to system design/reconfiguration are as follows: 1. Initial system size (in terms of processing capabilities). 2. Level of system agility. 3. Level of time and cost involved in reconfiguration. 4. Level of reconfiguration vs. expansion. Once a decision variable is confirmed for reconfiguration then it takes advantages of both lean (for waste elimination) and agile manufacturing (for quickly respond to customer requirement) in a leagile manufacturing system.

4. Advanced Manufacturing Technologies:

According to Linand Nagalingam (2000) and Wu (1994), "manufacturing is defined as the planned process by which products are formed by several production actions from the raw material". According to Winner (1997), "technology is concerned with three dimensions: apparatus, mentioning to equipment itself; technique, mentioning to the skills and information compulsory to practice the equipment; and organization, mentioning to systems and structures of control and harmonization. Advanced word depicts current stage of manufacturing. Thus, word "Advanced Manufacturing Technology (AMT)" came which depicts current period of manufacturing technology. According to Zammuto and O'Connor (1992), "Advanced Manufacturing Technology is a wide range of computer controlled automated process technologies. According to Beaumont et al. (2002), " Advanced manufacturing technologies are a collection of computer controlled technologies, including computer-aided design, computer numerical control machines, direct numerical control machines, robotics, bar coding, rapid prototyping, material requirement planning, statistical process control, manufacturing resource planning II, enterprise resource planning, flexible manufacturing system, automated storage and retrieval system, automated material handling system, automated guided vehicles. With the evolution of a number of advanced manufacturing technologies like predictive analytics, smart & connected products(IOT), advanced robotics, 3 D printing, AJM, EDM etc. manufacturing becomes quite easier and smooth which in turn saves a great extent of production time. It means quality products are produced with the elimination of waste (lean perspective) and provides a great flexibility in volume of production and product variety (agile perspective). Therefore, advanced manufacturing technologies becomes crucial factor from the point of leagile manufacturing system.

5. Quality tools & Technique:

Quality is a universal value and has become a worldwide issue. In order to survive and be able to provide customers with good products, manufacturing organizations are required to ensure that their processes are continuously monitored and product qualities are improved. Manufacturing organization uses various quality control techniques to improve the quality of the process by dropping its variability. According to Judi et al. (2011), a number of techniques are available to control product quality or process quality. These include seven statistical process control (SPC) tools, acceptance sampling, quality function deployment (QFD), failure mode and effects analysis (FMEA), six sigma etc. The efficient & constant operation of plant all over enterprise is important to achieve high production. As manufacturers consolidate through procurements and so have new services to function internationally, then they must learn by what method products can be made with constant quality and efficiency at each work location. This is where systems like lean production remove waste, completing uninterrupted actions for maximum efficiency and productivity, and where practices like Six Sigma reduce variability in methods/processes to ensure peak quality (agile perspective). Therefore, quality tools and techniques/practices should be in the leagile manufacturing system to achieve error-free working location and by this means a quality product obtained.

6. Supply chain management:

Christopher (2005) defines supply chain as the set composed by a company and all other companies with whom they interact, directly, through its suppliers and customers. According to Moura et al. (2008), a supply chain is defined as a set of organizations that withstand relations with each other from the start to the finish of logistic chain. Original lean thinking was closely related with the Toyota production systems and the work of Taiichi Ohno (1988), focusing on eliminating excess, waste and unevenness. Later, Lamming (1996) generalized this concept to encompass other industries and extended its application from manufacturing firms to supply chain management. A lean supply chain defined by Lamming (1996) was a plan which should offer a flow of goods, services and technology from source to sink (with related flows of information and other communications in both directions) without waste.

Agility is defined as a business-wide practice that comprises organizational structures, information systems, logistical processes, and employee mindsets (Christopher, 2000). In the late 1980s, customers demanded more variety, better quality, and greater service in terms of reliability and response time. In the late 1990s, global sourcing predominated through advanced telecommunications and transportation technologies. Globalization allowed a wide geographic dispersion of component manufacturing sites and places of final assembly. Competition was no longer among companies, but among supply chains. Based on supply chain frameworks, effectively merging leanness and agility became the primary concern, and the new concept ‘‘leagility’’ was proposed (Huang Yu-Ying et al., 2009).

Mason-Jones et al. (2009) projected a leagile model which shows lean manufacturing and agile manufacturing structures at different locations in a manufacturing supply chain. Decoupling point splits lean and agile system in supply chain (see Fig.2). The location of decoupling point has consequence on determining the structures of the supply chains, and hence one could decide when and where to adopt leanness or agility. Like Mason-Jones et al. (2009), van der Vorst et al., (2001) also analyzed the concepts of hybrid supply chain strategies and the decoupling point for a poultry supply chain experiencing high demand uncertainty in an inflexible production environment. Christopher and Towill (2001) argued that the real focus of supply chain reengineering should be on seeking ways in which the appropriate combination of lean and agile strategies can be achieved.

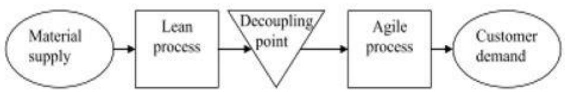

Fig.2 Leagile Supply chain [29]

Mainly two decoupling point recognized in a supply chain: the material decoupling point and the information decoupling point.

Christopher and Towill (2001) conceived three ways in which the lean paradigm and agile paradigm can be integrated to create an effective supply chain. Christopher and

Towill (2001) argued that there are three practical combinations, namely: within the same space but at a different time; in a different space but at the same time and a in different space and a different time in the supply chain. These were defined as: the separation of 'base' and 'surge' demand, the Pareto curve approach and the decoupling point approach. Christopher and Towill (2002) also suggested appropriate conditions for each of these hybrid strategies and claimed that these three combinations are complementary rather than mutually exclusive. The justification behind these three approaches was further explored by Stratton and Warburton (2003). They claimed that where there is a trade-off within the organization, separation principles can be applied for mitigating the impact of any conflict.

The 'decoupling point' was introduced by Hoekstra and Romme (1992), and defined as point in product axis to which the buyer's demand pierces. Later, Mason-Jones and Towill (1999) added that there are at least two pipelines within the supply chain, material flow and information flow and both flows have their own separate decoupling points. Therefore, they introduced the concept of 'material decoupling point' and 'information decoupling point'. This 'material decoupling point' resonates with the 'decoupling point' proposed by Hoekstra and Romme (1992).

Hoekstra and Romme (1992) give examples of simplified supply chain structures with various positions of material decoupling point, ranging from 'buy to order' at one extreme with a decoupling point well up the supply chain at the factory gates of the raw material supplier, via 'make to order' with the decoupling point just before the manufacturer/assembler, 'assemble to order' where that point is at the manufacturing/assembly plant, via 'make to stock' with the decoupling point between assembler and retailer, and 'ship to stock, with that point at the retailer as shown in Fig.3.

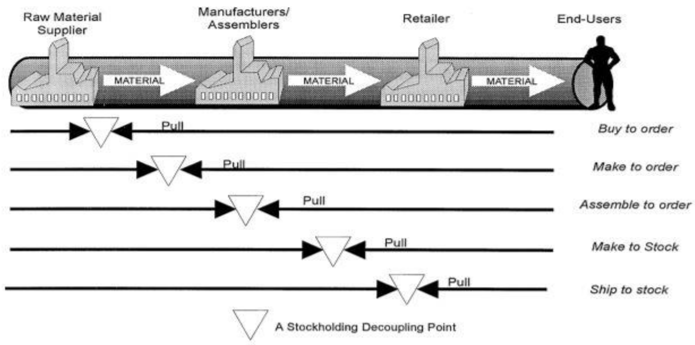

Fig.3 Position of decoupling point in leagile supply chain [35]

The manufacturers/ assemblers represent one or several businesses in the supply chain. Naim and Barlow (2003) made efforts to link these structures to different supply chain strategies- lean, agile and leagile supply chain. At one end of the spectrum, there are 'make-to-stock/ship-to-stock' approaches, which can offer products with short lead times or simply picked off the shelf. At the other extreme, the 'make-to-order/buy-to-order' approaches carry a low risk of stock obsolescence as the product is configured to actual customer requirements from the start of the value-added processes or the purchase of raw materials. These approaches feature high responsiveness. However, the precondition for adopting these two agile strategies is that customers are willing to accept a longer lead-time. A compromise situation is assemble-to-order, which typifies the leagile supply chain. The aim then is to trade-off the risk of stock obsolescence with the requirement of shorter lead-times.

The material decoupling point is also the point where strategic stock is held to buffer the upstream players from fluctuating customer orders and/or product variety (Childerhouse and Towill, 2000; Naylor et al., 1999). Several factors impact on the position of the material decoupling point. A rise in product variety and fluctuating volume of demand would force the material decoupling point to change upstream, which makes the supply chain more agile. In contrast, a more stable business environment with lower product variety and stable demand would move the material decoupling point downstream, making the supply chain leaner (Krishnamurthy et al.,2007).

A lean system is used upstream and agile is used downstream in a supply chain from this point. According to product configuration considerations, material flow decoupling point is selected in a supply chain (Naylor et al., 1999). According to Hoekstra and Romme (1992), Decoupling point indicates how severely customer order enters into the goods. It is also defined as the stocking point which separates activities that respond directly to customer orders from activities that are driven by forecasts and demand planning.

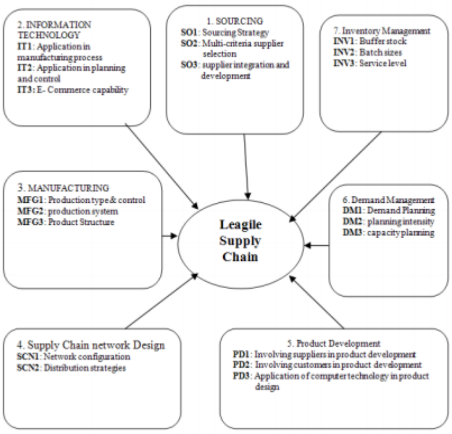

Fig.4 The conceptual framework model of leagile supply chain [37]

The above model is based on seven main constructs given by Ramana-Rao et al. of a leagile supply chain which are shown in fig.4.

7. Use of Information Technology:

In a global manufacturing environment, information technology plays a dominant role of integrating physically distributed manufacturing firms. Critical to successfully accomplishing AM are a few enabling technologies that include robotics, Automated Guided Vehicle Systems (AGVSs), Numerically Controlled (NC) machine tools, tools, Internet, World Wide Web (WWW), Electronic Data Interchange (EDI), Multimedia and Electronic Commerce (Gunasekaran ,1999). The influence of IT can not only improve productivity and quality of production, and service activities, but also permit enterprises to intelligently modify themselves. Through IT enterprises can collaborate with each other to accommodate various customers demand, changes in perceptions, design, time and quality while keeping the cost at a realistic level and hence overall enhance the efficiency of a leagile manufacturing system (Hasan et al., 2009).

8. Web-Enabled Technologies and Services:

Leagile-manufacturing means following the organization agility to respond rapidly to deviations in the marketplace, technology and clients by functioning as a virtual enterprise. To exist as a virtual enterprise web-enabled technologies and services are mandatory to assimilate and harmonize information collected based on contributions from clients, marketplaces, and technology. Web-enabled technologies and services supervisory gateway shall perform actively optimization and synchronization based on the collected information.

According to L. Jin et al. (2001), "web-enabled technologies and services in Networked Virtual Environments (NetVEs) gives an understanding, intuitive, and collaborative system and allows active communication among several operators. It offers engineers and creators to envisage, discover, work, and cooperate with manufacturing applications in the Net-VEs. In addition to this, industry handlers can effortlessly practice and share manufacturing information by web. By reducing expenses and cycle time of product development, such an leagile-manufacturing system will haste up the chief events of manufacturing engineering including simulating manufacturing methods; enhancing assembly lines and plants design; integrating labour and equipment, and hence, making improved quality goods in an ideal time at appropriate price.

9. Total Quality Management:

TQM is composed of three paradigms:1) TOTAL: Organization wide or made up of whole. Quality involves everyone and all activities in the company 2) Quality: Conformance to requirements (meeting customer requirements, agile system), 3) Management: The system of managing with steps like plan, organize, control etc. We define TQM more generally as a culture of sustained improvement targeting the elimination of waste in all systems and processes of an organization. It comprises everyone working together to make enhancements without necessarily making massive capital investments. TQM can occur through evolutionary improvement, in which case improvements are incremental, or though radical changes that take place as a result of an innovative idea or new technology (Jharkharia and Shanker, 2005). TQM is one the major pillars of lean as well as agile manufacturing.

10. Human Resource Management:

The introduction of Human Resource Management (HRM) gained a greater importance during the 1980's, where the key focus was to connect the three building blocks of human, resource, and management (Saha, Gregar & Sáha, 2017). The 'human' element focused on identifying ways to enhance the individual contribution and how to best 'manage' this asset in a professional setting. Thus, the focus on the employee as a 'resource' bringing value to drive business, became a central aspect for HRM (Flach, 2006). HRM can also be a strategic step, "responsible for obtaining, retaining, and maintaining qualified employees" (Saha, Gregar & Sáha, 2017). The overarching goal was to bridge the human asset with the organisation's strategic and operative management. Essentially, HRM became a movement away from the traditional HR, directing focus from administration and control of personnel systems, to the strategic vision and goals of the firm (Flach, 2006). The HRM approach therefore acted as a key to enhance the effectiveness, awareness, innovativeness and competitiveness by aligning the HR strategies with organisational learning (Saha, Gregar & Sáha, 2017).

The role of Human Resources (HR) varies significantly depending on company size, industry, and organisational structure. In today manufacturing era it is important to create a culture where the way of working and principles reflects a collective mind, illustrating the need of collaborating within the team. Technology shifts and development of new and more complex products puts pressure on firms to stay competitive on the market and challenge competition with new innovations (Steiber, 2014). For an organisation to maintain a continuous innovation rate and shorter product cycles, collaboration between the organisation and management is required, where the focus lies on the human capabilities. HR play a vital role in handling the coordination of the individual and intangible assets throughout the change process.HR practices should be focusing on creating motivation and empower the employees (Kotter, 1995). Changes within the traditional HR has led to the development of Human Resources Management (HRM), which specifically focuses on the integration of employees and the overarching strategic and operative vision of the organisation (Flach, 2006).

An approach to help organisations improve their agility is through the HRM strategy (Saha, Gregar & Sahá, 2017). It combines of organisational performance, organisational learning and organisational agility. The HR department provides the foundation of the 'technical infrastructure' that gathers and allocates knowledge to the organisation. Fig.5 presents the overarching impact of HRM on the organisational agility, where the central aspects of speed, adaptability and execution becomes a prerequisite to reach sustainable competitiveness.

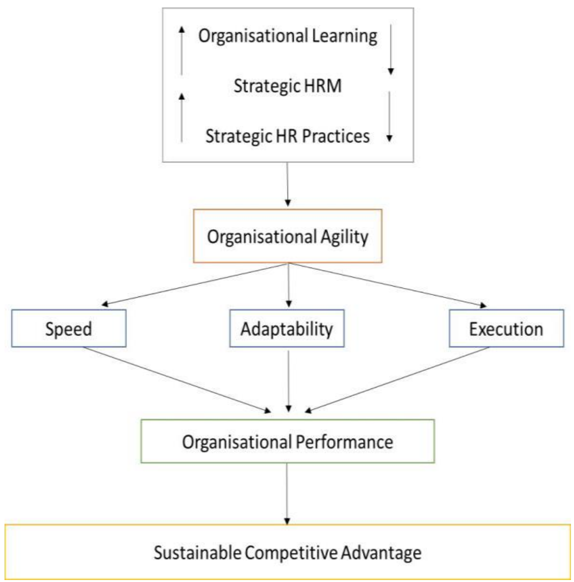

Fig.5 Model of HR's impact on Organisational Agility [39]

The employees are central in an Agile organisation, and one of HR's roles is to support and improve their situation (Larman & Vodde, 2009; Moreira, 2017). HR can take part in the creation of an environment where employees are motivated and productive (Moreira, 2017). HRM can also result in an organisation achieving its goals, through motivating and rewarding its employees (Saha, Gregar & Sahá, 2017).

Dealing effectively with lean production requires motivated, skilled workers and the integration of HR practices into a firm's production strategy (MacDuffie, 1995). Skilled and educated workers who are not motivated are dubious to contribute any discretionary effort. Motivated workers who lack skills or knowledge may contribute discretionary effort with little effect on performance. That is, lean production (LP) links together a set of manufacturing practices related to the minimization of waste, with another bundle of HR practices related to the expansion of work force skills and motivation. In LP, HRM aims fundamentally to support the standardization of work processes, the minimizing of deviations from these standards, the efficiency of the production process, the flexibility of workers, and close relations between leaders and workers. Some human aspects required in the leagile manufacturing system are:

a. **Motivatio**n: Job security, leadership, remuneration, empowerment etc.
b. **Work culture:** Quality of work life, managerial values, individual belief
c. **Top management commitment:** Commitment, leadership style, resource allocation, management style etc.
d. **Coordination:** Team value, trust
e. **Attitude change:** Education, positive thinking, awareness, responsibility
f. **Innovation:** Skill, urge to learn, economic condition

11. Strategic Management: "Lean strategy" in manufacturing involves a series of activities to minimize waste and non-value added (NVA) operations from production, customer relations, product design, supplier networks and factory management and improve the value added (VA) process. Applying lean strategies inaccurately, increases the inefficiencies of an organization's properties and reduced employee confidence in applying lean strategies. Similarly applying agile principles inaccurately, increases inefficiencies therefore a strategic management is required in a manufacturing system.

2. 4. CONCLUSION

The objective of research was to find and explain the importance of critical success factors (CSF) influencing leagile manufacturing system by literature review and in consultation of academicians working in concerned field so that leagile manufacturing system can be effectively implemented in industries. The factors that have been identified through literature review can be utilized to judge the leagility performance of an organization. With the help of CSFs, it is easier to do self-analysis and comparison of different manufacturing organization's. It has been clear from the earlier discussion use of supply chain management, advance manufacturing technologies are top most factors which affects overall leagile manufacturing system. The training and development plans on several areas like six sigma, total productive maintenance, 5S, kaizen, Kanban, jidoka, poke yoke, rapid reconfiguration, advance manufacturing technologies, CNC, automation, robotics etc. should be planned so that the staffs should be well familiar with newest machineries and quality tools and practices to make a better leagile system.

Leagile Manufacturing system implies that a manufacturing is quickly responding to the market conditions as well as customer demand with effective cost reduction. Lean manufacturing reduces waste and tries to maximizes profits with the help of lean tools and techniques through cost reduction while agile manufacturing focus on exactly what the customer demands in shortest possible time. Identification of CSF's for leagile manufacturing system gives an enhanced version of manufacturing.

A leagile index may be prepared on the basis of critical success factors, sub factors and their interdependencies which is helpful in deciding the leagility of manufacturing firm by using digraph theory. A survey can also be performed on the basis of critical success factor, sub factors and their independences.

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