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## ROLE OF LEAN MANUFACTURING IN PRODUCTIVITY IMPROVEMENT OF SMALL AND MEDIUM SCALE INDUSTRIES

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**Abstract:** In today's global competitive environment, manufacturing enterprises are adopting cost effective manufacturing systems to improve their productivity. Improvement in productivity is closely related to success and survival. Industries and researchers are focusing their research work on developing various techniques of productivity improvements. Lean manufacturing, Total Quality Management, and Total Productive Maintenance are being gaining much importance. It was proven that lean manufacturing is considered as the best manufacturing system in the 21st century. From the literature review, it has been observed that lot of research has been done on implementation of lean manufacturing in large scale industry. The small and medium scale industry sector (SMEs') play an important role in the industrial development of any country. This sector has been facing problems of global competition and low productivity. This research paper focuses on the importance of lean manufacturing in productivity improvement of small and medium scale industries. The aim of this paper is to explain the Importance of productivity for SMEs', various causes for low productivity and suggest suitable lean manufacturing tools to improvement of productivity.

**Keywords:** Small, medium, enterprises, manufacturing waste, productivity, lean manufacturing.

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## INTRODUCTION

In the changing globalized environment has been posing challenges of competitiveness and survival to all the constituents of the economy. It has been more so for SMEs in the manufacturing sector. It has been noticed that units are so engaged in their day-to-day management issues that they don't have time and resources to dedicate for a strategic understanding of the need and acquiring means of various techniques which would help them in enhancing their productivity and hence being competitive in the world markets. Lean Manufacturing is a set of techniques, which have evolved over a long period and are based on various minor to major breakthroughs that help in reducing cost and hence increase productivity and competitiveness [1].

### 1.1 SME Sector in India

SMEs are officially defined and exclusively identified for promotion in the manufacturing sector of most national economies. The most important justification for the exclusive promotion of SMEs is their potential for employment intensity. However, there is no uniform definition of a SME in the global economy. Different countries have defined SMEs in different ways. In Japan, a SME in the manufacturing sector is defined in terms of upper limit of paid-up capital of 300 million Yen or 300 employees (Small & Medium Enterprise Agency, 2004). In South Korea, SMEs are defined as firms, which are independently owned and employ less than 300 persons in the manufacturing, mining, and transportation and construction sectors [2].

In India, the enterprises have been classified broadly into two categories First is Manufacturing enterprises and other those engaged in providing/rendering of services. Both categories of enterprises have been further classified into micro, small and medium enterprises.

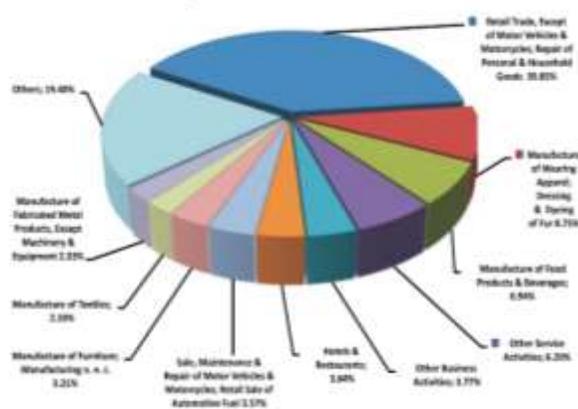


Fig.1 Leading industries in SME Sector

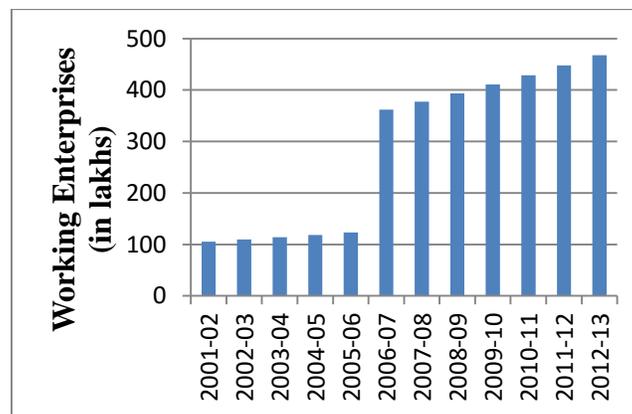
The table below gives the classification of micro, small and medium enterprises based on their investment [2].

Classification	Manufacturing Enterprises	Service Enterprises
Micro	Rs. 25 lakh	Rs. 10 lakh
Small	Rs. 5 crore	Rs 2 crore
Medium	Rs 10 crore	Rs 5 crore

**Table No.1 classification of SME on the basis of Investment**

### 1.2 Role of Small and Medium Scale industries in industrial development

Small and medium scale enterprises have long believed to be catalysts for economic growth of nation for both in developed and developing countries. It plays an important role for employment generation, facilitator of economic recovery and national development. The SME's sector in India is highly heterogeneous in terms of the size of the enterprises, variety of products and services produced and the levels of technology employed, while one end of the SME's spectrum contains highly innovative and high growth enterprises [3].



**Fig.2 Development of SME sector since 2001**

For the developing countries like India it is very important to improve the performance of SME's due to following reasons.

### 1.3 Contribution of SME in Gross Domestic Product

Gross Domestic Product or GDP represents the economic health of a country. It presents a sum of a country's production which consists of all purchases of goods and services produced by a country and services used by individuals, firms, foreigners and the governing bodies. GDP is used as an indicator for most governments and economic decision-makers for planning and policy formulation, SME's play an important role to strengthen the GDP [2]. Table 2, shows the contribution of SME's in GDP [3].

Year	Gross Value of Output (Rs in Crore)	Percentage Share of SME's		
		Total Output	Manufacturing	Gross Domestic Product (GDP)
2006-07	1998817.55	42.02		7.73
2007-08	1322960.41	41.998		7.81
2008-09	1375698.60	40.79		7.52
2009-10	1488390.23	39.63		7.49
2010-11	1655580.60	38.48		7.42
2011-12	1790804.67	37.52		7.28

**Table 2: Contribution of SME's in GDP**

#### 1.4 Contribution of SME in Capital Investment

Research on economic development has suggested a significant role for capital investment in economic growth, capital investment make any country more productive. In other words, new machinery, better technology, and more investment in infrastructure are the key ingredients for industrial development [3]. Fig. 3, shows the amount of fixed capital investment in the SME's sector

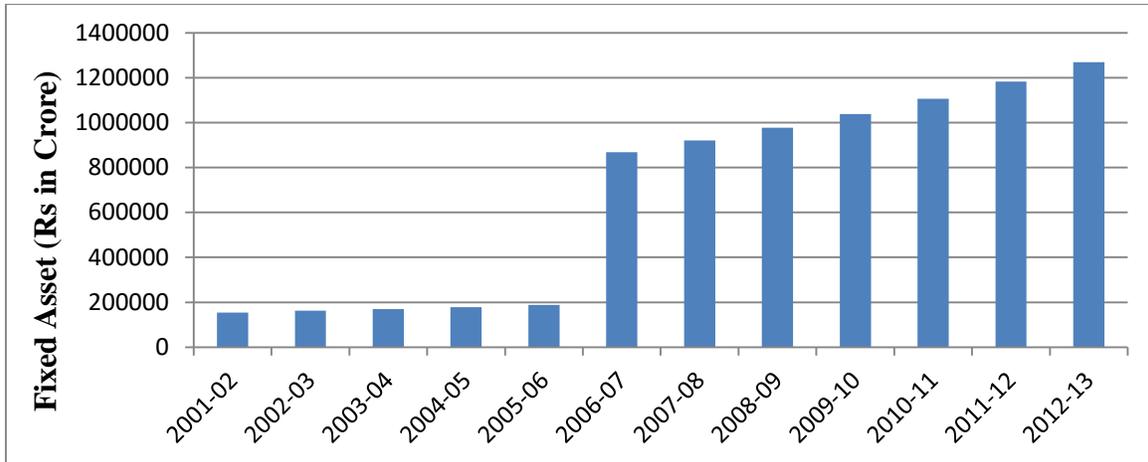


Fig.3 Fixed capital investment in the SME's sector

### 1.5 Contribution of SME in Employment generation

For industrial development and overall growth of any country employment is very important SME's play an important role in creation of employment Table no 2 shows the performance of SME's for generation of employment and investment [3]. Fig. no 4 shows the Generation of employment by SME sector.

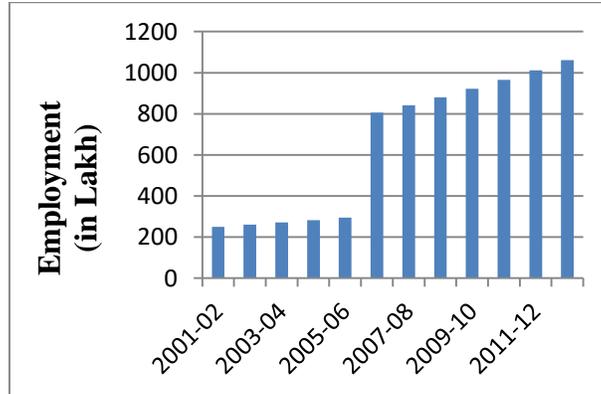


Figure No. 4 Generation of employment by SME sector.

### 2.0 Importance of productivity for an organization

Productivity is a measure of the efficiency of production. High productivity can lead to greater profits for businesses and greater income for individuals. Productivity is defined as a measure of quantifying the output against the amount of input. It expresses the relationship between the quantity of goods and services produced (output) and the quantity of labour, capital, land,

energy, and other resources to produce it (input). Rapid increase in demand of production, manufacturing industries need to increase their potentials in production & effectiveness to compete against their competitors [4],[5].

The only meaningful measure of industrial competitiveness is productivity and hence this topic is widely discussed especially in the manufacturing sector due to its solid link to the organizational profitability [6]. Importance of productivity in business can be summarized as follows.

- Productiveness increases the overall efficiency of an organization.
- Enhanced production and lowers the cost per unit of a product.
- Lower cost production resulting in better sales and profits.
- Enhances a business' competitiveness in the market.
- Increases the confidence of investors in the organization
- Reputation and goodwill of the organization increases.
- Boosts the morale of the employees as they get to enjoy a part of the profits and the satisfaction of a job.

### **2.1 Problems or causes for low productivity in SME**

As the productivity play an important role in the development of any organization but majority of SMEs are facing the problem of low productivity. The reason for the low productivity is depend on the various factors and it may vary from organization to organization. The Primary Causes for Low Productivity in organizations are as follows: Ineffective use of resources, Non-productive /unnecessary activities, Low labor productivity, Worker disputes, Poor information flow, Excessive rework, Waste of material, Frequent machine breakdowns/stoppages, High variability of cycle time, and Excessive inventory. [7], [8].

### **2.2 Areas required to be improving for higher productivity**

Many researchers suggested the various strategies to improve productivity. Jan [9] suggests that reduction of throughput time is an effective strategy to improve productivity of manufacturing firms irrespective of the size, nationality and type of the industry. Wacker [7] states in their review that investment in both human and equipment resources will improve

plant efficiency and the manufacturing productivity is also increased from various non-production activities such as well-defined tasks, employee improvement suggestions, and the interaction of production employees with equipment engineers. However, according to Jan [9], factors such as investments in new technology, motivating employees through gain sharing, computer aided information management and planning systems and management restructuring could not be associated with the productivity improvements. On the other hand, studies in Japan by Yamada [10] stated that there is a significant positive influence of capital resources on productivity. Many organizations look for solution to their problems outside instead of attempting to improve themselves, but solutions in many cases is available in the organization itself. Productivity is required in all areas of the organization. The activities that lead to improve productivity should be critically studied. The major areas where improvement is required to increase the productivity are operator, process, machinery, equipments and workplace .Lean manufacturing techniques help in improving these areas to increase productivity [11].

### **3.0 Need of lean manufacturing for small and medium scale industries**

The understanding of productivity has been further complicated by a growing realization that simply producing effectively does not necessarily mean one is productive. One must be producing what the marketplace needs, when it needs it, and at a competitive price. The ideal of meeting customer needs and expectations without error or waste has now entered the equation. This suggests that anything produced that the market does not want cannot be considered an output when calculating productivity. So now the output side of the calculation is also complex [4].

Lean manufacturing is a system whose techniques aim to significantly eliminate waste in the manufacturing process. Japan had learned management and improvement techniques/methods such as industrial engineering (IE) and quality control (QC) from Europe and America. Those methods were further developed in Japan and resulted in the technique known throughout the world as Kaizen. During this movement, Toyota developed their own unique methods in manufacturing. The concept was completely different from the mass production method [12].

### **3.1 The basic concept of lean manufacturing**

The use of the term "**Lean**" in a business or manufacturing environment, describes a philosophy that incorporates a collection of tools and techniques into the business processes to optimize time, human resources, assets, and productivity [13]. Becoming "Lean" is a commitment to a

process and a tremendous learning experience to implement Lean principles and practices in the organization. Lean manufacturing defines the value of a product or a service with the customer point of view. Lean production typically represents a shift from conventional “batch and queue,” functionally aligned mass production to “one-piece flow,” product-aligned pull production. This shift requires highly controlled processes operated in a well maintained, ordered, and clean operational setting that incorporates principles of just-in-time production. To accomplish this, companies employ a variety of advanced manufacturing tools to lower the time intensity, material intensity, and capital intensity of production. Lean manufacturing typically targets waste and complexity in process parts that is not required to meet customer needs.

### **3.2 Seven deadly wastes in lean manufacturing.**

Waste is defined as anything that does not add value to the final product. Essentially, "waste" is anything that the customer is not willing to pay for. Following are considered as a waste in lean manufacturing: Overproduction, (Production ahead of demand), Waiting, (Waiting for the next production step), Unnecessary transport, Over processing or incorrect processing, Excess inventory, Unnecessary movement or motion, Defects and rework. (The effort involved in inspecting for and fixing defects) [14].

### **3.3 Benefits of implementation of lean manufacturing**

- Reduction in manufacturing time
- Better Utilization of Space
- Increase in productivity
- Waste to profit relationships
- Improvement in working culture [15]. Above are only the quantified and most common advantages. But there are more and more other advantages come with lean manufacturing among them are
- Good team spirit which will drive your organization to the excellence
- Innovative culture in the organization
- Self driven people

- Pleasant working conditions
- Worker involvement and improved worker satisfaction
- Longer machine life
- Systematic approach to work
- Improved flexibility
- Environmentally friendly
- Built in quality [16]

### 3.4 Objectives of lean manufacturing.

The main objectives of the lean manufacturing are as follows: Reduction of different type of waste, increasing the productivity, Introducing innovative practices for improving overall competitiveness, Inculcating good management systems, imbibing a culture of continuous improvement [1].

### 3.5 Lean tools for productivity improvement.

Lean manufacturing has a set of primary and secondary tools. The tools are very simple, easy to understand and can be used by the shop floor personnel, but the adequate training and understanding is required to get the required benefits. The uses of tools depend on the area of applications, some of the basic tools for the productivity improvements are explain in the table no 3[11].

Lean Tool	Meaning	How Does It Help?
5S	Sort (eliminate that which is not needed), Set In Order (organize remaining items), Shine (clean and inspect work area), Standardize (write standards for above), Sustain (regularly apply the standards)	Eliminates waste that results from a poorly organized work area (e.g. wasting time looking for a tool).
Bottleneck Analysis	Identify which part of the manufacturing process limits the	Improves throughput by strengthening the weakest

		overall throughput and improve the performance of that part of the process.	link in the manufacturing process
<b>Continuous Flow</b>		Manufacturing where work-in-process smoothly flows through production with minimal (or no) buffers between steps of the manufacturing process.	Eliminates many forms of waste (e.g. inventory, waiting time, and transport).
<b>Heijunka (Level Scheduling)</b>		A form of production scheduling that purposely manufactures in much smaller batches by sequencing (mixing) product variants within the same process.	Reduces lead times and inventory
<b>Jidoka (Autonomation)</b>		Design equipment to partially automate the manufacturing process and to automatically stop when defects are detected.	Workers can frequently monitor multiple stations (reducing labor costs) and many quality issues can be detected
<b>Just-In-Time (JIT)</b>		Pull parts through production based on customer demand instead of pushing parts through production based on projected demand.	Highly effective in reducing inventory levels. Improves cash flow and reduces space requirements.
<b>Kaizen (Continuous Improvement)</b>		A strategy where employees work together proactively to achieve regular, incremental improvements in the manufacturing process.	Combines the collective talents for continually eliminating waste from manufacturing processes.
<b>Kanban (Pull System)</b>		A method of regulating the flow of goods both within the factory and with outside suppliers and customers. Based on automatic replenishment through signal cards that indicate when more goods are	Eliminates waste from inventory and overproduction.

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		needed.
<b>Muda (Waste)</b>	Anything in the manufacturing process that does not add value from the customer's perspective.	Eliminating muda is the primary focus of lean manufacturing.
<b>Poka-Yoke (Error Proofing)</b>	Design error detection and prevention into production processes with the goal of achieving zero defects.	It is difficult (and expensive) to find all defects through inspection, and correcting defects typically gets significantly more expensive at each stage of production.
<b>Root cause Analysis</b>	Focuses on resolving the underlying problem instead of applying quickly. A common approach is to ask why five times – each time moving a step closer to discovering the true underlying problem.	Helps to ensure that a problem is truly eliminated by applying corrective action to the “root cause” of the problem.
<b>Standardized Work</b>	Documented procedures for manufacturing that capture best practices (including the time to complete each task). Must be “living” documentation that is easy to change.	Eliminates waste by consistently applying best practices. Forms a baseline for future improvement activities.
<b>Total Productive Maintenance (TPM)</b>	A holistic approach to maintenance that focuses on proactive and preventative maintenance to maximize the operational time of equipment.	Creates a shared responsibility for equipment that encourages greater involvement by plant floor workers.
<b>Value Stream Mapping</b>	A tool used to visually map the flow of production. Shows the current and future state of processes in a way that highlights opportunities for	Exposes waste in the current processes and provides a roadmap for improvement through the

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	improvement.	future state.
<b>Visual Factory</b>	Visual indicators, displays and controls used throughout manufacturing plants to improve communication of information.	Makes the state and condition of manufacturing processes easily accessible and very clear – to everyone.

**Table no 3: Basic tools for productivity improvements**

#### 4.0 CONCLUSIONS

To compete in the global market Indian SMEs should gear up to satisfy its customers with world class quality, right time delivery and better services. To achieve these goals productivity plays an important role. To improve the productivity in all areas of an organization, identification and elimination of waste is essential. Lean manufacturing techniques promises to enhance the productivity by reducing the different type of wastes. The organization must be aware that change does not happen overnight; the result from implementing such a system may come slowly. This paper suggest that for successful implementations of lean manufacturing in any organization, identification of the wastes hindering the productivity and selection of the right lean tools for the given situation is very important. This paper also helps to understand the importance of SMEs sector their contribution in the industrial development and focuses on need of enhancement in the productivity of this sector by implementation of lean manufacturing.

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