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Productivity improvement in the Manufacturing Industry through The Implementation of Lm Tools

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Abstract - Lean manufacturing is a set of principles and practices that may improve a company's efficiency and competitiveness in the marketplace. Lean manufacturing aims to maximize efficiency and productivity without compromising on product quality. Quality improvement is crucial since it reduces expenses by eliminating defective products. When production times are lowered, associated labor and infrastructure costs per unit are lowered, too. The elimination of unnecessary steps and processes is fundamental to the lean manufacturing philosophy. This might streamline, speed up, and enhance the process as a whole. Many companies have found success with lean manufacturing because it allows them to achieve their productivity targets and more by using straightforward, repeatable processes. Therefore, quality improves, production increases, and costs decrease. Participants were asked to rate the effectiveness of the implementation of these initiatives. After averaging the means across all scales, statistical analyses may be performed.

Keywords - Manufacturing Industry, Implementation, Lm Tools

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INTRODUCTION

Lean manufacturing (LM) or the Toyota Production System (TPS) was established by a Japanese car company, Toyota, and has since been adopted by almost every country in the world due to its cost, quality, flexibility, and reaction time benefits. Lean manufacturing is a strategy for maximizing customer value while decreasing costs. The focus of value stream optimization is always on the end user. According to the tenets of lean management, every activity that fails to directly benefit the customer should be minimized or eliminated. Lean manufacturing aims to improve value for customers by reducing production costs, increasing output per unit of time, and improving product quality. There are many different ways to describe "lean manufacturing."

Lean Manufacturing Procedures

1. The system's waste is first detected; this requires many different types of organizations to become conscious of the wastes both visible and invisible that exist inside their own processes.

2. A company may collect a wide range of trash, including as It is important to know how to categorize trash and where it comes from. Lean manufacturing seeks to identify root causes and implement lasting solutions. Several efficient tools and strategies have the potential to significantly cut down on the production of such rubbish.

3. The third step is to use common lean techniques and concepts to isolate the issue's origin. It is vital to identify how the suggested change will influence the larger picture since cause-and-effect analyses may be deceptive.

4. The last step in implementing lean is identifying problems and conducting preliminary tests of potential solutions. The next stage is to implement the tested strategies. Each of the aforementioned procedures relies heavily on training and subsequent monitoring to be effective. Since the real implementation might take some time, patience is essential.

LITERATURE REVIEW

Alalawin, et al (2022) Understanding where the system fails and where the processes are flawed—

both of which have a domino effect on performance and efficiency—is a major issue for lean adoption in the service sector. This research presents a new approach that might help service providers improve lean implementation and better align appropriate Key Performance Indicators (KPIs) with overall company goals. This article draws on a global best practice to examine the many forms of waste that reduce service delivery efficiency. To overcome the limitations of more traditional tools, this method aims to use and integrate the KPIs with Lean Management Tools. The first step in reducing or doing away with waste of any kind is to design a new KPI lean method. Improved procedures, higher performance, increased time and effort efficiency, and improved precision are all expected outcomes of this approach. With low-performance tasks in mind, a new model was created. The proposed framework is also used to create quantifiable key performance indicators (KPIs) that may be used to identify issues and guide future improvements. Consistent use of the method is likely to result in a significant cutback in waiting time and non-value-adding activities for service providers. Monitoring and controlling processes and activities inside an organization may be improved as well. Lean management may also help the telecom sector since it allows for a more rapid response to the ever-evolving telecom technology, which might lead to greater customer satisfaction.

Joseph, et al (2021) This report outlines the research and testing conducted by a Chennai-based firm that supplies timing belt to original equipment manufacturers. The major emphasis of this study is on how to use lean manufacturing concepts to increase output from the production floor. Using Overall Equipment Efficiency (OEE) in manufacturing allows for more precise troubleshooting of complex issues that affect output. Analyzing cycle times helps businesses assess how well their different productivity-enhancing factors are working. A new set of processes was implemented after carefully examining cycle times, and the outcomes were compared to those of the past to see whether they were an improvement. The previous range of slabs produced per hour was 7.32–7.97, although current rates are closer to 7.32. Following the first day of applying measures to reduce the variation in cycle time, output increased from 8.9 to 9.1 slabs per hour, a 19.1 percent increase.

Mishra, Sushil & Terker, Ravi (2022) The research presented here aims to educate readers about lean manufacturing as a whole, from the idea behind it to the wide variety of tools and techniques used in the process, as well as the benefits gained and challenges faced along the way. By making more effective use of resources and wasting less of them, lean techniques increase productivity. Most marketplaces are becoming more competitive, thus efficient manufacturing is essential. Because of how quickly business and its environment are changing, companies may anticipate facing challenges and complexities. It's an efficient strategy for cutting down on pointless waiting around. The goal of this study is to assess the relevant literature and extract the most significant and applicable findings. Lean manufacturing is an umbrella term for several methods of streamlining production. A company's culture must be changed in addition to using most of the lean technologies for lean to be successful. Manufacturers that use lean manufacturing are better prepared to respond to changes in the market.

Rahmanasari, D & Sutopo, Wahyudi & Rohani, J. (2021) Due to inefficient practices, the industrial sector is often criticized for producing vast quantities of trash. The production of electronic components, for instance, is still dealing with significant waste issues. They squandered resources, which hurt their competitive position. Using a lean manufacturing strategy, this research will show how waste may be reduced. The goal of this study is to identify inefficient processes in lean production and suggest ways to improve them. Value stream mapping (VSM) and waste relationship matrix (WRM) techniques were utilized to identify and analyze the industrial waste stream. The next step is to utilize a waste assessment questionnaire (WAQ) to determine how often trash needs to be picked up. Value Chain Mapping (VALSAT) is a program that uses Value Chain Mapping to create a complete map. Three different approaches are examined: the net present value, the internal rate of return, and the profitability index. We made a list of all the garbage in the system and decided the third biggest one was the one we should clean up first. Based on the data analysis, it was determined that increasing the amount of production equipment, carrying out the appropriate maintenance procedures, giving additional training and supervision, and building more workstations would improve the production process. In general, the suggested rules help the company lessen the seven waste and raise the unit production. It is envisaged that this would lead to a more streamlined production procedure.

Susilawati, Anita (2021) It may be challenging for the organization to create an effective performance evaluation system that can drive continuous development because of its mission and its many different aspects. The study's overarching goal is to develop performance measurement systems (PMS) that may boost the effectiveness of a very lean firm or organization. The PMS uses the Multiple Incremental Decision Making and the Fuzzy Analytical Hierarchy Process to get its decisions. Using the hierarchical levels as decision makers, fuzzy human judgment was converted into clear scores based on pair-wise comparisons. Hierarchical systems and various performance criteria may connect tactical operational operations to strategic levels. It might assist a company keep tabs on its progress toward its goals, giving its management more data with which to work when making strategic and operational decisions. The flexibility of the PMS architecture allows the system

to be optimized for the company's specific needs. In order to determine the viability and potential effectiveness of the lean PMS model, a case study was conducted.

METHODOLOGY

Table 3.1 shows that in order to have a good Cronbach's Alpha, one of the layout items has to be removed. Other than that, construct dependability is over the threshold in all other relevant categories. Validity was determined by consultation with experts and review of relevant literature. Six professors and two working professionals in lean manufacturing participated in the pilot project. Based on their feedback, we made a few changes before sending out the surveys. The validity of the constructs was examined using principal components analysis. The analysis was performed without the items that did not load onto a single factor (or with them included in another factor). Each factor's Eigen value and explained variance are both more than 0.5, as seen in Table.1. Everything's over the 0.5 cutoff for acceptable factor loadings. Kaiser-Meyer-Olkin (KMO) values for sample adequacy are all higher than the cutoff value of 0.5, hence this statistic likewise passes the smell test. It is safe to use the parts or key regions in other research since they are all reliable and legal.

Table 1: Reliability and Validity Test Results

Key Areas	Cronbach's Alpha	Items Deleted	Eigen Value	% Variance Explained	Items for Deletion	Items Loading Range	KMO Value
Scheduling	0.688	None	1.893	63.095	None	0.767-0.814	0.671
Inventory	0.869	None	2.892	72.303	None	0.818-0.890	0.754
Material Handling	0.842	None	2.289	76.296	None	0.853-0.897	0.719
Equipment Work	0.878	None	2.413	80.424	None	0.887-0.916	0.735
Processes Quality	0.856	None	3.228	64.566	None	0.687-0.867	0.797
Employees	0.819	None	2.681	67.021	None	0.685-0.916	0.732
Layout Suppliers	0.864	None	2.850	71.250	None	0.795-0.929	0.720
Customers	0.600	1	1.431	71.552	None	0.846	0.500
Safety and Ergonomics	0.702	None	1.892	63.063	1	0.621-0.906	0.540
Product Design	0.780	None	2.140	71.342	None	0.798-0.888	0.680
Management and	0.812	None	2.226	74.194	None	0.785-0.945	0.569
Culture	0.821	None	2.263	75.420	None	0.774-0.918	0.662
Tools and Techniques	0.947	None	4.143	82.860	None	0.864-0.931	0.883
	0.817	None	2.923	58.458	None	0.685-0.867	0.749

RESULTS AND ANALYSIS

Application Of the Integrated Model for The Case Study of Auto ComponentManufacturer

In this research, we'll analyze just one of the many thriving corporations out there. The authors demonstrate the provided methodology by integrating VSM, Plant Layout, FFMEA, FAHP, and FQFD using a case study from the discrete manufacturing industry. The characteristic of the discrete manufacturing industry is the production of individual, easily identifiable products. Automobiles, electronics, toys, and household appliances are just some of the many products that are produced by discrete producers. The suggested concept is tested with a car components maker.

Industry Profile of Auto ComponentManufacturer

The selected industry is a forerunner in the manufacture of car components in southern India. Location: Tirupur district, Tamil Nadu state, India. In 1983, it debuted on its expansive 120-acre plot. The cutting-edge framework is the home to all the amenities. Its two main divisions are casting and machining. The industry is one of the few in the nation with its own machining area, where components created by casting are finished. Outsourcing the machining of just 5% of the components is more than manageable. The firm manufactures many important car safety parts, such as rotors, brake drums, and brake discs, as well as steering knuckle joints. We have chosen to focus on the following companies: Maruti Suzuki, Honda Siel Cars, Hyundai, Fiat, Ford, General Motors, Toyota, Renault, Volkswagen, Tafe, Mahindra & Mahindra, Volvo, and Haldex.

Selection Of Production Line for Illustration

Because it is illustrative of the industry as a whole, the steering knuckle production line will be examined. An example of a modern vehicle's steering knuckle is shown in Figure1.

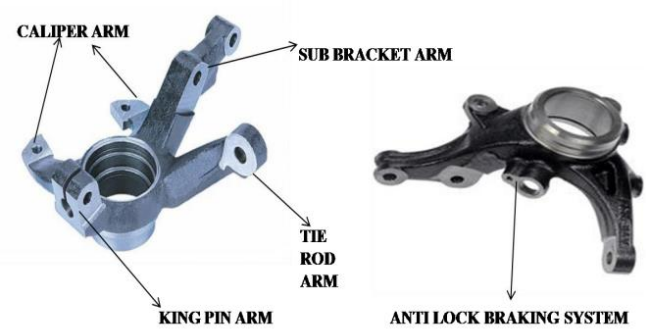

Figure 1. Steering knuckle

Figure 1. shows the process of making a steering knuckle. Here are the stages of this development:

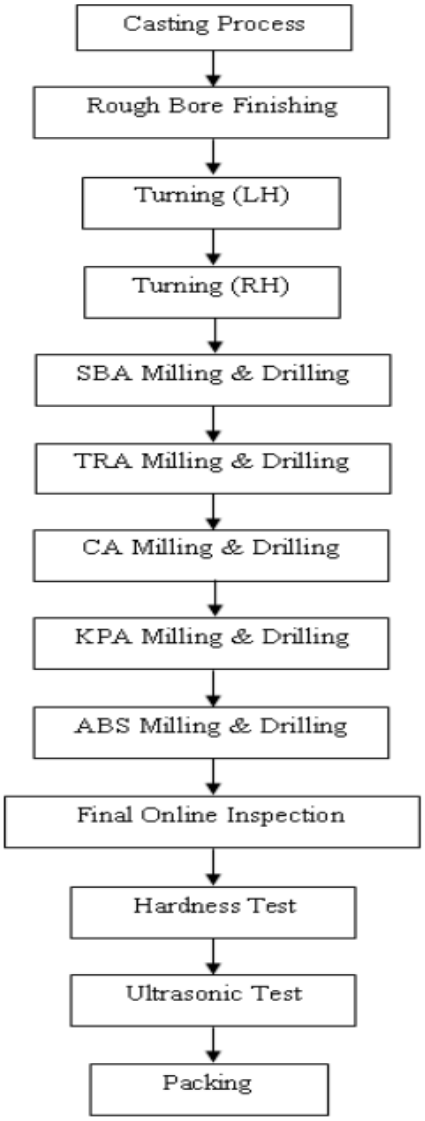

Figure 2. Process of steering knuckle manufacturing

- **Casting:** The steering knuckle is made by sand casting. The item has been sent to the machining facility.

- **Turning:** Turning is the first machining technique used on the knuckle to get the main component for assembly. The knuckle is machined on both the left and right sides using LH and RH side turning, respectively.

- **Milling & Drilling:** In order to get the parts of the steering knuckle, milling and drilling are used. Faces of components are made using a series of operations including milling (Sub Bracket Arm, Tie Rod Arm, Caliper Arm, King Pin Arm, Anti-Lock Braking System) and drilling.

- **Inspection:** All finished parts, including machined surfaces and profiles, are measured and inspected when machining is complete. If a part has a significant enough variation from the standard, it will fail the inspection and be thrown away. No diagnostic checks are made to make sure these mistakes aren't made again.

- **Hardness test:** The reliability of the component is next examined by testing its surface hardness and other mechanical properties.

- **Ultrasonic test:** Ultrasonic testing is a nondestructive technique for locating defects inside an item. Furthermore, any defect caused by stress during milling may be uncovered by ultrasonic testing. If the right machining conditions were created throughout production, and the quality of the casting was confirmed by testing after it was made, then it is possible that these defects may be completely avoided.

- **Packing:** The last step is to package the component and store it in the finished goods warehouse until it is time to ship.

CONCLUSION

The effect of Lean Manufacturing (LM) techniques on increasing industrial productivity is investigated in depth in this study. In this research, we found that LM tools have the ability to significantly improve efficiency, cut down on waste, and streamline operations. Overproduction, surplus inventory, and needless motion are just a few examples of the types of waste that have been significantly reduced by the use of LM techniques like 5S, Kanban, and Value Stream Mapping. Streamlining production processes and optimizing resource utilization are both achieved by methodically removing these inefficiencies. Based on the findings, LM tools help reduce mistakes and faults, which in turn improves product quality. In addition, producers can stay ahead of the competition in today's ever-changing business environment because to the flexibility that LM brings to the table. Significant cost savings may be achieved with the deployment of LM tools. These

tools help reduce waste, optimize resource utilization, and increase overall operational performance. Manufacturing enterprises become more competitive in the global market as a result.

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