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# A Content Analysis on Lean Manufacturing - Concept and Benefits for Manufacturing Industry

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***Abstract:*** ***Nowadays, every organization must be required to determine its strength and weaknesses to enlarge productivity and output of their operations. The concept of lean production system has been acknowledged as a means to increase competitiveness for manufacturing concerns all over the world. The present paper has been planned to analyze the concept of Lean Production and its benefits for manufacturing industries. On the basis of the content analysis, the study found that lean manufacturing is gaining popularity day by day among manufacturing industries due to its potential of increasing operational performance. This is done with the help of its set of tools and principles which are used in the systematic elimination of seven wastes, namely, over-production; waiting; scrap; conveyance; processing; inventory; and motion. Elimination of wastes enable manufacturer to produce the product with superior quality, lower cost and on time with lesser efforts.***
***Keywords: Lean Production, Benefits, Tools and Techniques, Principles***

## I. INTRODUCTION

In today's competitive atmosphere, every organization must be required to determine its strength and weaknesses to enlarge productivity and output of their actions. The concept of lean production system has been acknowledged as means to increase competitiveness for manufacturing concerns all over the world. The main purpose of this production system is to satisfy the customers by providing the precise product (according to customer's specifications), better quality, quantity, and lower cost in the shortest time period.

This system provides a number of tools and techniques which are useful in waste identification and minimization of wastes. Abolishing of wastes led reduction in excess production and inventory; avoid over-processing and superfluous movement of material and workers. This production system is examining each and every step of the manufacturing process which adds value to the product. If any step does not add value to the product, the manufacturer delegates these non-added value steps to a subcontractor or outsourcing company for the purpose of focusing on value-added operations of its core

The concept of lean manufacturing is popularized in the last decade. It is based on "less is better" method to production, which led to a simplified, extraordinarily organized surroundings that is cautiously altered to the manufacturer's anxiety. In this method, the goods are produced according to the customer's specifications not for batch manufactured for hoard. The purpose is to manufacture only the quantity specified by the customers because extra production will require more investment on its accommodation process.

There is no doubt that it does not provide answer for all the industrialized or manufacturing troubles but it offers an exclusively elastic answer for assembling more multipart products. In the present chapter, we study the concept of Lean Manufacturing from the different perspectives of experts and compare it with other's philosophies. This paper is intended to explain concepts of Lean Production System; principles and its benefits. The tools and techniques of lean production system are also discussed in the later section of this paper.

## II. SECTION-II

### *A. Objectives of the Study*

*1)* To study the lean production concept and its principles.
*2)* To understand the benefits and tools and techniques of lean production system.
*3)* To suggest suitable recommendations

### *B. Database of the Study*

The present study revolves around the above-said objectives. To achieve these objectives of present study, a number of empirical and conceptual research papers have been analyzed. In addition of this, a number of books published national as well as international has also been studied in detail.

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## III. SECTION-III

### A. *Lean Production Concept*

The concept of lean production have been defined by many experts like Lewis, M.A., 2000; Hines, P., Holweg, M. & Rich, N., 2004; Shah, R. & Ward, P.T., 2007, but all these definitions are unclear. These vague definitions lead to communication difficulties (Boaden, R., 1997) and create complexities in implementing the Lean Production concept in enterprises as well as in establishing its clear-cut objectives (Andersson, et al. 2006).

A number of different definitions are available for the lean term, which creates the problem in the identification of real benefits of its use (Parker, 2003). The lack of exact definition makes it complicate to set up if the changes occurred within a company are or not in accord with the principles of the Lean Production, which leads to a laborious evaluation of the efficiency of the concept (Manea, D. 2013. So, there must be required to examine the achievement of the Lean Production system before executing it, in order to avoid wasting time and funds.

Firstly, the term Lean production system was used by Jim Womack, Daniel Jones and Daniel Roos in their book entitle as, 'The Machine that changed the world' (1991). Lean Production can be defined as an idea or as a strategy which depends on a set of practices used to reduce waste in order to improve the performance of an enterprise (Womack, J.P., Jones, D.T. and Roos, D., 1991). Womack, et al. analyzed the manufacturing activities of the Toyota Motor Company. Lean manufacturing is considered as 'the systematic elimination of waste' (ibid, 1991). Thus, Lean Production system comes from the Toyota production system, a concept used by most of the companies across the world in an effort to remain competitive in an increasingly globalize market (Pérez M. P.; Sánchez A.M., 2000; Hosseini Nasab, H., et al. 2012).

Lean is focused at cutting "fat", similarly in case of Lean Production; lean implies cutting fat from manufacturing activities. It has effectively useful in both, managerial and manufacturing activities. Though lean manufacturing is a moderately new term, but its numerous tools were found by Fredrick Taylor and the Gilbreaths at the end of the 20th century. It is a technique of Japanese which is based on 3M's, namely, (i) Muda (waste); (ii) Mura (inconsistency) and; (iii) Muri (unreasonableness).

It means that lean production system is used for the elimination of waste (Muda), overburden (Muri) and unevenness in work loads (Mura). Muda focuses on activities of elimination of wastes, waste is an activity that does not adds any value to the product. These wastes are i) Over-production; ii) delay; iii) excess in movement of materials and people; iv) less effective process design; v) production of defective goods; and vi) ineffective performance of a process. Muri applies on a number of manufacturing and managerial activities. On the other side, Mura is a problem that increases the inconsistency in manufacturing activities.

It is clear from the above discussions that Lean Production conceptually refers to the just-in-time practices which help in optimal utilization of resources; improve the production process and; systematic elimination of waste.

### B. *Lean Production Tools*

Without the discussion of pillars or tools of lean manufacturing, the concept of lean production would be incomplete. This system has a number of tools and techniques which are used by employees at all levels to make processes more efficient. This lean production system was initially applied in the manufacturing concerns, where this system was confirmed to be relatively doing well. But, principles of Lean production system can be used to almost any business concerns.

The focal point of a Lean production system is the 'value creation' or 'value addition'. It implies that each and every activity of an organization is evaluated on the point that it creates the value to the products or not. If it does not create any value to the product, then it should be considered as waste.

It is clear from the literature that the Lean Production system is primarily based on the just-in time production method. In this method, the detailed planning of the production process is prepared and determines the exact amount of raw materials and used this material where they are needed.

In every step of the production process only the amount needed must be obtained and it should be done only when it is required by the next working stage, according to the technological flux (Manea, 2013). The main purpose of lean production approach is the improvement in the competitiveness and performance of an enterprise through the reduction of costs and time and improvement in quality and productivity. All these are done by eliminating the non-value activities, using tools such as just-in-time, cellular manufacturing, Value Stream Mapping, 5S, Kanban (pull) systems, kaizen, flow and poke-yoke.

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Lean Production Tools

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| Just-in-Time | The concept of lean production is based on the TPS Model of Toyota Motor Company. The Lean Production system is primarily based on the just-in time production method. Therefore, we can say that the Toyota Motor Company was established the concept of just-in-time manufacturing. Just-in-Time employs a pull system which offers the assembly line with only the things they require, only when they necessitate them. It is a production scheduling concept that requires only the required things at the required time and in the essential quantity using minimum necessary resources for the production process. |
| Cellular Manufacturing | Cellular manufacturing method is based on the principles of group technology. The machines are arranged in such a way so that it helps in easy transition from one production process to another one. Therefore it provides a number of benefits, namely, minimum handling of materials (less motion), better speed of working (fast speed), reduction of unnecessary costs and stocks (less costs and stock). |
| Value Stream Mapping | The method of Value Stream Mapping is applied to design and scrutinize the production process. As it name suggests that it is used to create a simple for managers to visualize the value flow. The value refers to a thing that brings a product in the form preferred by the customers who are willing to pay for it (Kocakulah, et al. 2008). The main purpose of this method is to recognizing the wastes in all the production processes in order to eliminate them. In other words, we can say that this method is used to systematic elimination of wastes, namely, motion; waiting; movement; over-production; transpiration, over-processing, defects etc. |
| 5S | 5S is another basic tool of Lean Production, which is applied in the Toyota Motor Company. This program has provided a number of benefits, namely, keep discipline, minimizing production and handling time which leads to lower overheads. These benefits are come through its five steps, which are as follows.<br>• Seiri (separate) – Elimination of non-value added activities<br>• Seiton (sort) – Recognizing the steps of production processes and the elements which are required for the performance of the tasks. These steps and elements are arranged in such a way to control unnecessary time on handling. Everything must be on their right place.<br>• Seiso (sweep) – Each and everything must be kept clean. All the wastes and scraps must be removed from the production place.<br>• Seiketsu (standardize) – In order to increase efficiency of productivity, there must be required the standardization of processes.<br>• Shitsuke (sustain) – Maintenance of cleanliness everyday. |
| Kanban (pull) System | It is an effective lean tool to control the material handling process, so it is also known as stock control system. Generally it is performed by FIFO method. Sugimori (1977) acknowledged that this system has many benefits over computer technologies, namely, reduced cost of information processing; it is a simple way to get and spread information in a dynamic environment. He criticized the lack of respect for the human being of the enterprises whose production was controlled by computer systems (Manea, D. 2013). The Japanese believe the Kanban system more translucent, allowing employees to understand the production process without the need to use complex software (ibid, 2013). |

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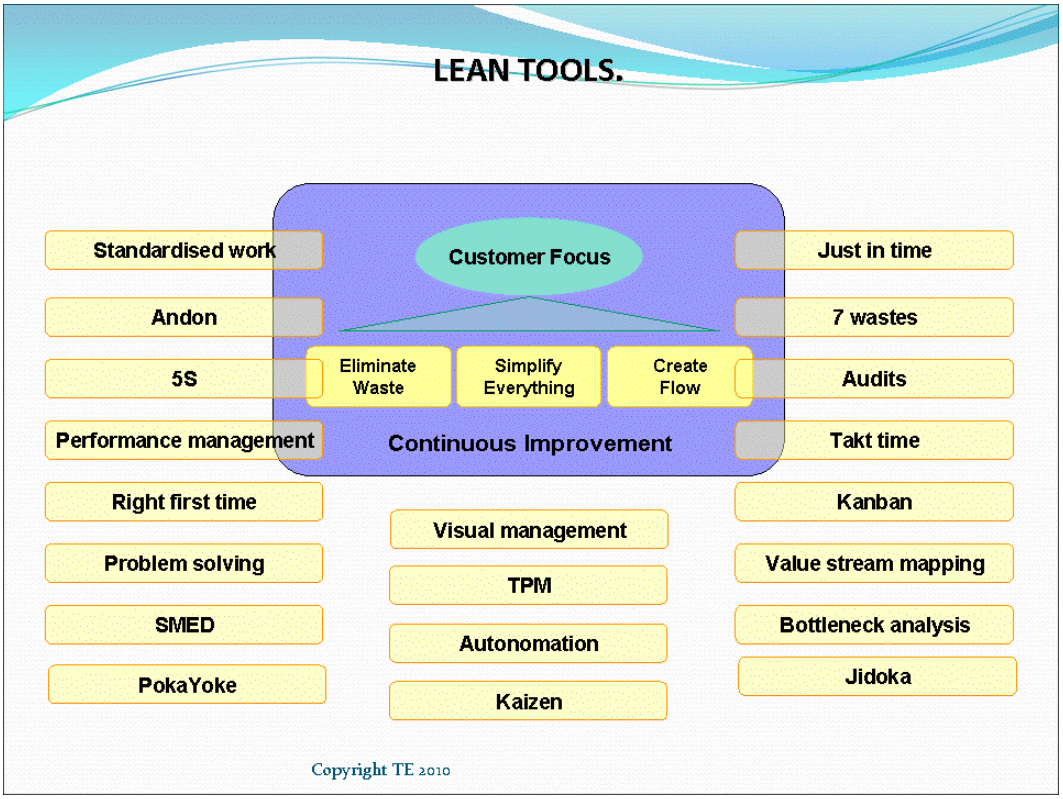
| Jidoka | This method represents the ability of humans or machines to discover an abnormal condition in materials, machines, and processes. It is also helps in removing these abnormalities so that they cannot pass from one process to another. However, in this system, machines and processes are designed in such a way that they immediate detect errors and automatically stop production when a problem is placed. Therefore, this system reduces waste in the form of wasted time on production of defective goods. |
| Kaizen | Kaizen is used for the process of continuous improvement. |
| Takt Time | It is the time in which a unit must be created in order to match the rate of customer demand. It is calculated by dividing available time with unit demand. |
| Poke-yoke. | It is an instrument that helps workers to avoid mistakes. The main purpose of this method is to minimize product defects by preventing, correcting, or drawing attention to mistakes of workers. |
| Hansei–Hansei | It is used to identify the mistakes of workers so that they can be controlled in the future. |
| Andon | It denotes visual management system which highlights a spot where action is required. It is activated by pulling a cord or pushing a button, which mechanically stops the production line. |
| Heijunka | The main purpose of this method is to streamline or sequencing the production process. |
| Genchi Genbutsu | It is the best way to re solve a problem is to see it in person. It implies that managers must be required to spend time on the factory floor for the better understand the surroundings of routine actions. |
| Nemawashi | In this system, all the decisions should be made as a team or group. |

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*C. Lean Production Principles*

There are a number of key lean manufacturing principles that require being implicit for the implementation of lean production system. Womack and Jones (1996) recognized the five principles for the implementation of lean production system in an organization. These five principles are the spine of any lean production system. These are, (i) the value is determined by the point of view of the customer (Customer Value), (ii) Value Stream, (iii) Flow, (iv) Pull and (v) improvement.

Lean Production Principles

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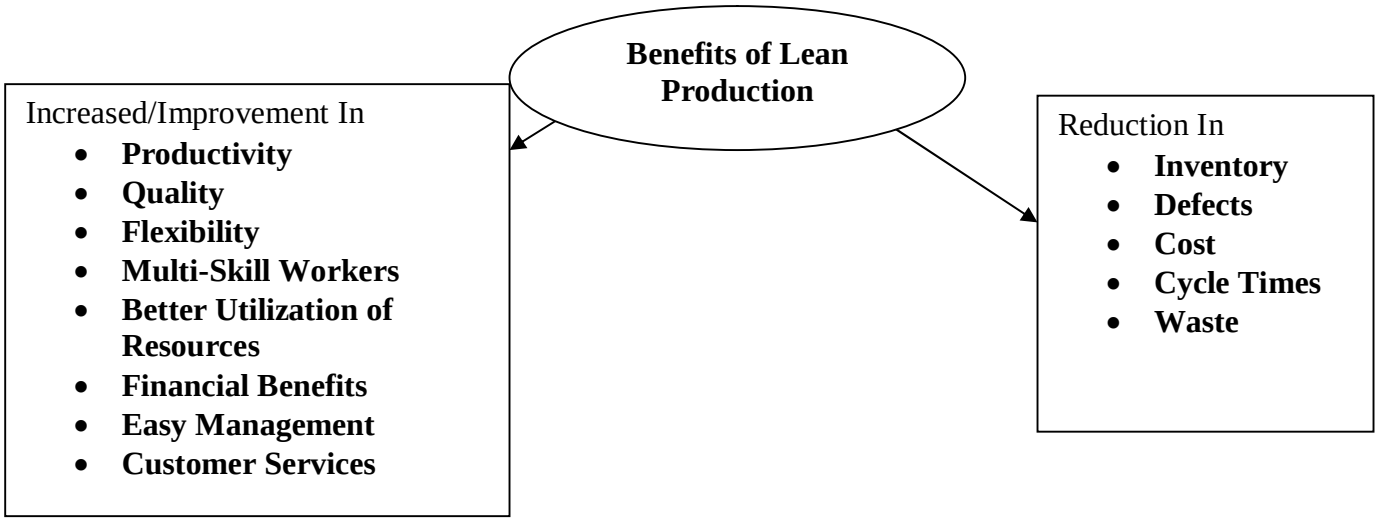
| Customer Value | Identify value from the view point of customers. It implies the specific product with specific qualities offered at special prices for a specific customer. |
| Value Streams | It is the process of systematic elimination of non-added value activities. It denotes a set of specific actions required to produce a given product, based on the three management tasks: the task to resolve all the problems starting from the concept through a detailed design to the commence of production; from order taking, through detailed planning, to delivery and physical conversion of the raw materials into a finished product ready to be handed to the customers (Womack and Jones 1996). |
| Value Flow | Several processes of production are organized in such a way to produce a specific product by which the product smoothly flows to its customers. |
| Pull | Lean production is depends upon the principle of pull system which clearly limits the quantity of products entering the production process. Under this approach, the production of products are started after the order placed by the customer. On the other hand, the traditional method of production is based on push system in which there is no any limit of quantity of products in the hope that it will be purchased by the customer in the future. The main disadvantage of this approach is that it led blockage of funds in the form of materials and storage capacity. |
| Continuous Improvement | Continuous improvement is another principle of the Lean Production concept. So it helps in reducing efforts, costs, space used, and production time can be continuously achieved. |

*D. Lean Production Benefits*

The Lean Production concept is considered as the most important approach for the manufacturing industries. Lean production approach provides a number of benefits to the manufacturing industries, by which they can attain the higher rate of inclusive growth. The focal point of lean production system is on waste elimination, lowering cycle time, minimizing defects and reduction of response time and work in progress inventory. All these operations positively increase the performance of any organization. The typically benefits of lean production system are as follows.

**Figure: 1**
**Lean Production Benefits**

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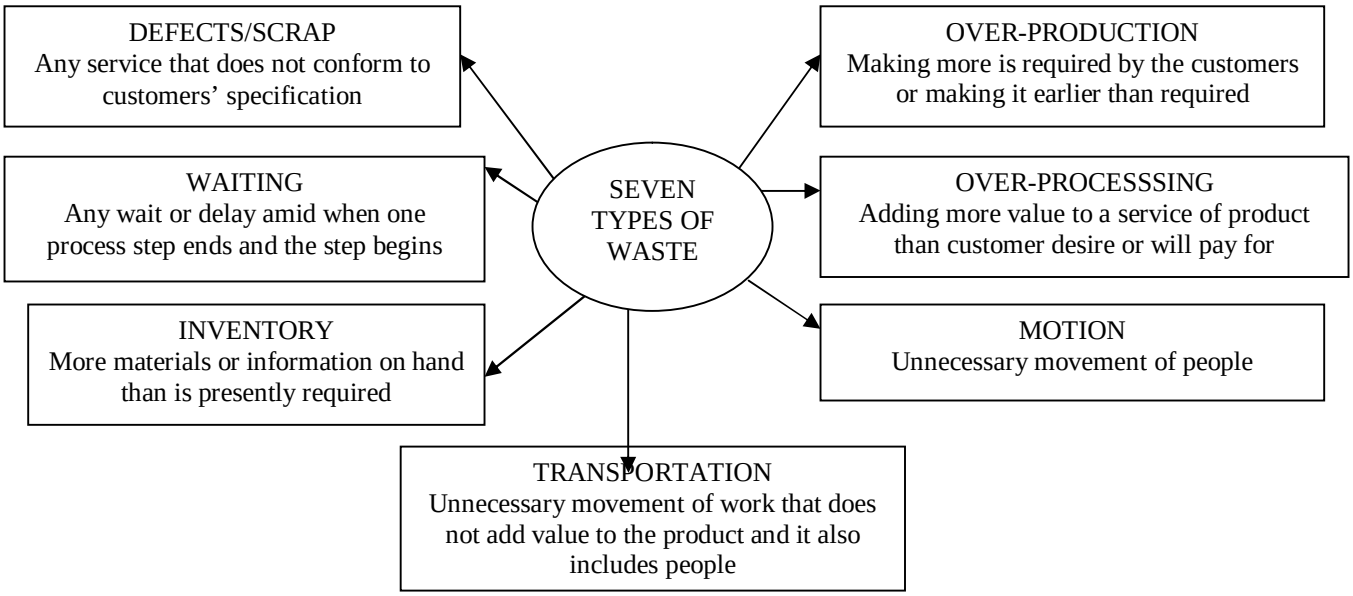
1) *Higher Rate of Productivity:* Lean production system helps in reducing waste of motion or the idle time of workers and, it ensure that when they are working, they are using resources in an optimal manner. Therefore, it led more efficiency in work which will help the organizations to produce more products for the same expenses, ultimately it increases profits.
2) *Reduced Defects:* In this system, all the production processes are designed in such a way that there is no any unnecessary physical wastage due to any production of defective items. The production of defective items led higher cost due to excess use of raw material inputs and labour working hours.
3) *Reduced Cost:* Lean Manufacturing organizations can attain many benefits like, reduced cycle times; improved labor productivity; and abolition of bottlenecks and condensed machine downtime. These benefits can significantly increased productivity with reduced cost with the same means of production.
4) *Reduced Inventory:* Lean production system helps in minimizing inventory levels at all stages of production. Minimum inventory level ensures lower blockages of funds in the form of stock.
5) *Improved Quality:* Several activities are conducted for the improvement of quality of goods and services under the lean approach. It helps in improving the speed of processes and quality through reduction of process waste.
6) *Minimum Cycle Times:* Lean approach helps in reduction of production cycle time by reducing waiting times amid processing stages, as well as process preparation times and product conversion times.
7) *Reduced Lead Time:* With the help of reduced cycle time and work in progress inventory lead time to manufacture is considerably reduces.
8) *Improved Flexibility:* Under lean approach, the manufacturer have the facility to produce a more flexible range of products with less cost, time and efforts.
9) *Multi-Skill Workers:* Participation of worker in diverse Lean tools, namely, value stream mapping; kaizen circle; flow; quality circles; time reduction; layout improvement; etc. generates better understanding of processes, machines, material flow amongst the team-members and increase core competencies of worker.
10) *Better Utilization of Resources:* It leads to better utilization of resources by eliminating bottlenecks of production processes.
11) *Waste Reduction:* Waste is an important product within any process. The Lean Approach is focused on improving process speed and quality through reduction of process waste. Waste consumes energy, money, and is of no value to the customer. An additional approach, namely, Six Sigma which also aims to make processes and the business more efficient, identifies waste as results from variation within the process and tries to reduce it by eliminating variations in the process. In the Lean Approach, reduced waste means less transport, less moving, less waiting, less space required and reduces all variations throughout the process. It is one of the main functions of Lean Manufacturing. Lean approach helps in systematic elimination of waste which is of seven types. These are overproduction, defects, transportation, inventory, over-processing, waiting and motion.

Figure 2
Seven Types of Wastes Eliminated by Lean Production System

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12) *Financial Benefits:* Under lean approach, the financial benefits are highly enormous due to the declining in waste and defects and improvement in quality. Elimination of waste reduces cost and better product quality ensures higher profit. The funds saved on product storage and inventory management plus additional cash flow in the company.
13) *Improved Customer Service:* It is based on the first principle of Lean in which a businessman is identifying value as perceived by the customer. Customers need to be provided with what they want, when they want and where they need it. It implies that the producer produced the goods and services according to their customers' preferences. By following this rule, the customers are satisfied in the long run.
14) *Easy Management:* Lean approach is based on the principle of 'getting more done with less people'. As waste is reduced, there is less space and manpower required to manage. The workflow results in manufacturing cells which puts machines close together so that a single operator can manage many pieces of equipment with the minimal energy. After the implementation of the system, the main aim of workers is to increase their skill-level and well-organized the system. Under this system, each individual worker within a work cell tries to improve his or her performance. A role of the management is to go on the factory floor and check what is happening and in accordance provide additional training, promotion, and learning.

## IV. CONCLUSION AND RECOMMENDATIONS

In today's competitive atmosphere, every organization must be required to determine its strength and weaknesses to enlarge productivity and output of their actions. The concept of lean production system has been acknowledged as means to increase competitiveness for manufacturing concerns all over the world. The main purpose of this production system is to satisfy the customers by providing the precise product (according to customer's specifications), better quality, quantity, and lower cost in the shortest time period. Lean approach is based on the principles, namely, customer value, value stream, pull, value flow and continuous improvement. Lean manufacturing provides a number of tools and techniques to improve the performance of manufacturing industry and create the desired benefits to survive in today's competitive environment.

It is obvious clear from the above discussions that the implementation of the Lean Production principles will improve the whole process of production. The rationale of this approach is that of reducing costs by abolishing waste and by increasing customer satisfaction, which ultimately rising the performance of the business.

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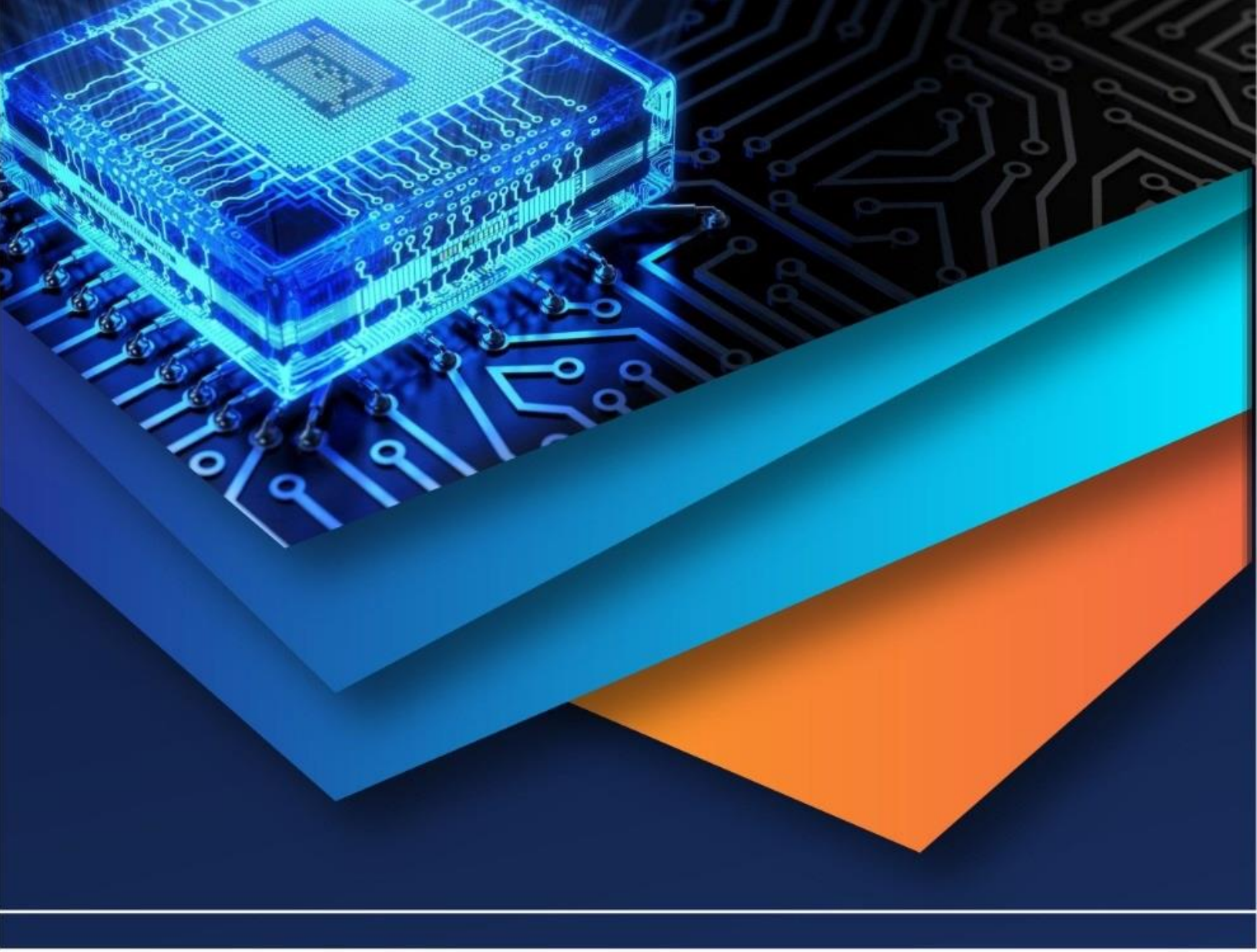

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