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Application of Value Stream Mapping in Papad Manufacturing

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Abstract: ***A Value stream is all the actions (both value added and non-value added) required to bring a product through the main flows essential to every product for the production flow from raw material into the arms of the customer. Value Stream Mapping (VSM) techniques are used in some big companies like Toyota. Value Stream Mapping (VSM) is the one of the lean manufacturing tool. This paper addresses the implementation of value stream mapping in Papad industry. Value Stream Mapping aim is identified waste in terms of non-value added activities. Current state Map is prepared to give details about the existing position and identify various problem areas. Future state Map is made to show the implementation action plan.***
Keywords*:* ***Value stream mapping, Lean Manufacturing tool.***

I. INTRODUCTION

The Value is defined as the worth of what customer is paying for. Value adding activities are those activities which add some virtue of worthiness in a product for which customer wants to pay. The value stream is that which is refers only to particular (Specific) parts of the firms that actually add value to the specific product or service under consideration. [1]
In 1999, Peter Hines et.al defined VSM as a new variant of process benchmarking for the development of a supplier network around a prominent distributor of electronic, electrical and mechanical components in supply chain context. This involved mapping the activities of the firm identifying opportunities for improvements and then undertaking the firm with an improvement program. [2]
VSM is about eliminating waste whatever it is. Various terminologies used in VSM are discussed as below:

A. TAKT Time

The rate which a company must produce a product to satisfy its customer demand. [3] It is calculated by dividing available working time per day (in minutes or seconds) to customer demand per day (in relevant units).

B. Production Lead Time

It is the total time a component takes in its ways through the shop floor, beginning with arrival of raw material to shipment of finished goods to customer.

C. Value Adding Time

It is the time which is utilized in adding actual value to the product.

D. Current State Map

It describes the existing position of shop floor of any manufacturing facility.

E. Future State Map

It describes the future position of shop floor of any manufacturing facility in order to bring some *improvement.*

F. Kanban

It is a signal in Japanese word that means card and which is used to reduce inventory.

G. Pull Production

Producing exactly according to the pace of customer requirement.

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According to Rahul R. Joshi, G.R. Naik (2012), Value Stream Mapping is used to identify the current process of small scale industry. The current state map is used to identify the wastes. A future state map is created with the wastes activities eliminated and improve process cycle time and reduce work in process inventory. [4]

Mimnun Sultana and M.M. Nazrul Islam (2013) have described a case study to describe the scope of value stream mapping to initiate lean manufacturing by analyzing an apparel industry of Bangladesh. This apparel industry was facing high lead time and wastages. Current state map has been prepared for a process showing processing time 24.49 days, retention time 131.38 days and total lead time about 155.87 days. Improvements are then made in current state map and after analysis of future state map it was found that processing time reduced to 23.202 days, retention time reduced to 10.158 days and total lead time was reduced to 33-36 days. Comparing current state map and future state mapping, it can be easily seen that the value addition increases from 15.71% to 69.55% approximately and a significant reduction of no value added activity by retention time has been achieved. [5]

Priyank Srivastava, Dinesh Khanduja and V.P. Agarwal (2014) proposed a study with purpose of developing a plan for reducing lead time and increasing throughput in a product manufacturing plant by using value stream mapping. The plant produces rubber screening media and wear products used in mining and aggregating industry that is sold throughout the western hemisphere. The rubber manufacturer was inefficient because it produces product in batch quantities and has poor product flow due to operations being departmentalized. Because of this the manufactures was experiencing high lead time. [6]

K.P. Paranitharan (2015) carried out a case study based of VSM in Brass Lamp Manufacturing. A seven step methodology was used to eliminate non value adding activity and for productivity improvement and to study the impact of VSM on industry. [7]

II. VSM METHODOLOGY

A. VSM has four major steps as given by Rother and shook. [8]

1) Select a product family.
2) Draw current state map.
3) Draw future state map.
4) Develop work plan for implementation future state.

Value stream Map uses special symbols to represent where there is waste in manufacturing process and to help find ways to eliminate that waste. VSM symbols are shown as below.

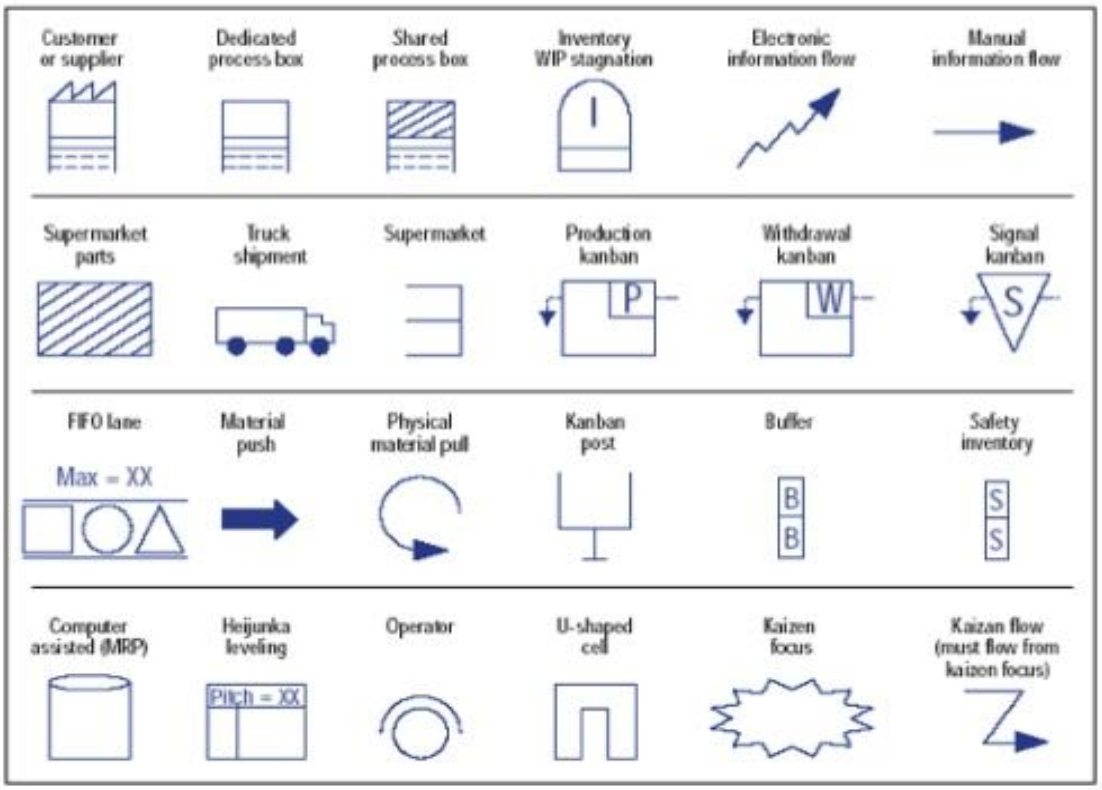

Fig. 1 VSM Symbols

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III.CASE STUDY

A case study is conducted at Papad Industry and some of the observation is taken in implementing VSM.

A. Selection of Product Family

The first step is the selection of the product family from the product mix for study. This critical product family should be chosen after studying the product mix thoroughly. This product family will be ground for further study.

B. Current State Map

The Figure 2 shows the current state value stream mapping of Papad manufacturing. All the data for current state map were collected with the consultation of workers, supervisors, engineers and managers. During the manufacturing process of Papad, various processes are identified i.e. mixing, dough making, hand rolling, drying, manual weighting and packaging process. In the current state mapping of Papad manufacturing, cycle time is the value added time. The waiting time and set up time are non value added time. In the current state value stream mapping "Takt Time" is calculated. "Takt Time" refers to the rate at which customers are buying products from the production line, i.e. the unit production rate that is needed to match customer requirement. It is calculated by dividing the total available time per day by the daily customer demand. As per requirement of 10000 kg. in 8 hr. shift, Takt time is calculated as :

$$\text{Takt Time} = \frac{\text{Available working time}}{\text{Customer demand}} = \frac{8 \times 60 \times 60}{10000} = 2.88 \text{ Sec./Kg.}$$

To complete the value map, a timeline is added at the bottom of the map recording the value added time and non value added time. Finally, it is found that about 50 min. were value added activities, compared to 18.94 min. of non value added activities.

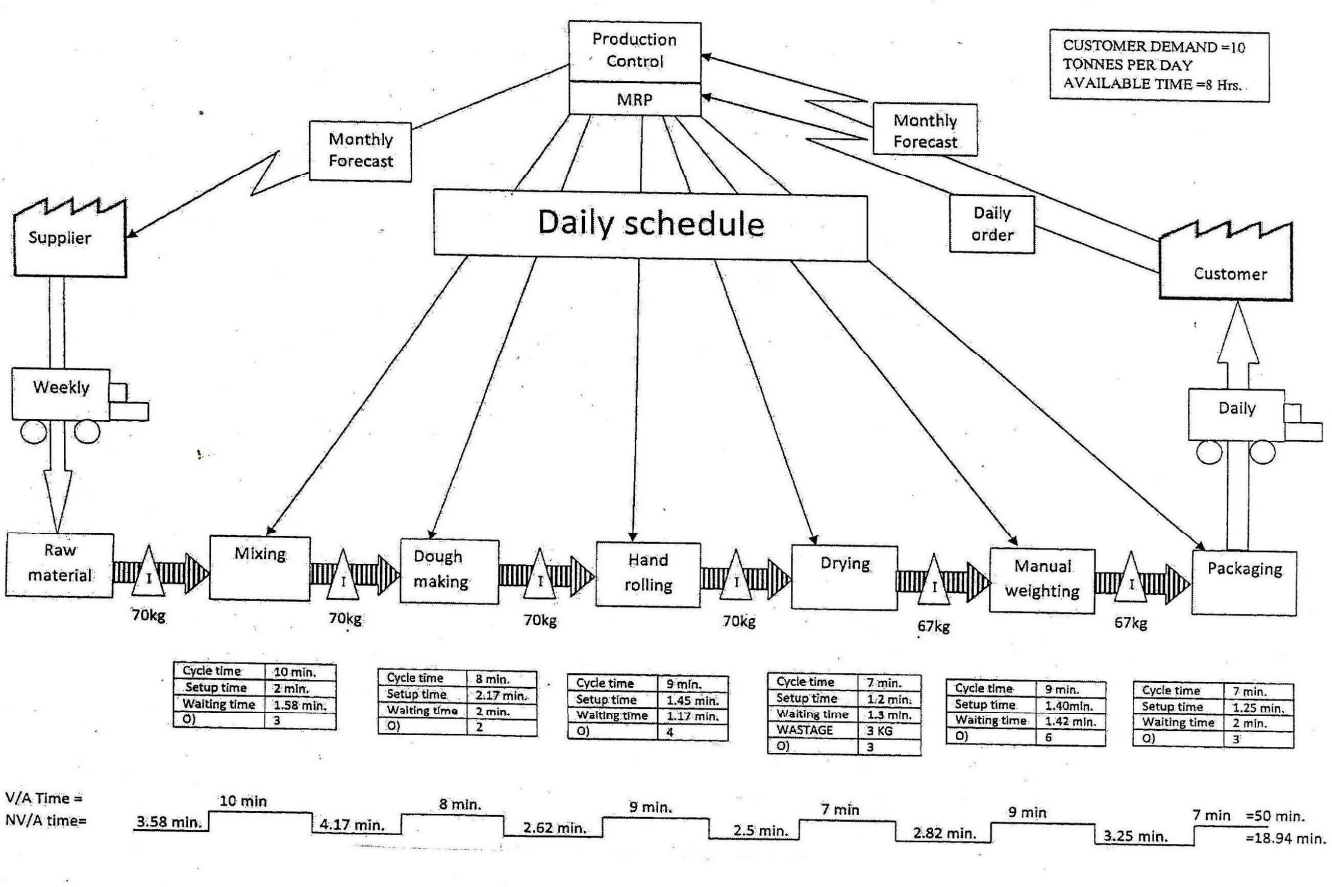

Fig. 2 Current state value stream mapping of Papad manufacturing

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C. Future State Map

The Figure 3 shows the future state value stream mapping of Papad manufacturing. A future map identified improvement to be made to the value stream that will eliminate the waste. During the manufacturing process of Papad, in the manual weighting process, quantity of Papad is weighted manually. In this process cycle time consumed is 9 min. and set up time consumed is 1.4 min. The cycle time and set up time will be reduced. In the packaging process, packaging is done by automatic packaging machine. During the packaging process, waiting time consumed is 2 min. which will be reduced. In the future state value stream mapping of Papad manufacturing, cycle time and set up time is reduced by the use of automatic weight machine instead of manual weight machine. The cycle time is reduced from 9 min. to 3 min. and set up time is reduced from 1.4 min. to 0.35 min. The waiting time is reduced in packaging process by reducing the gap between packaging process and weighting process. The waiting time is reduced from 2 min. to 1.33 min. Hence overall value added time is reduced from 50 min. to 44 min. and overall non value added time is reduced from 18.94 min. to 17.22 min.

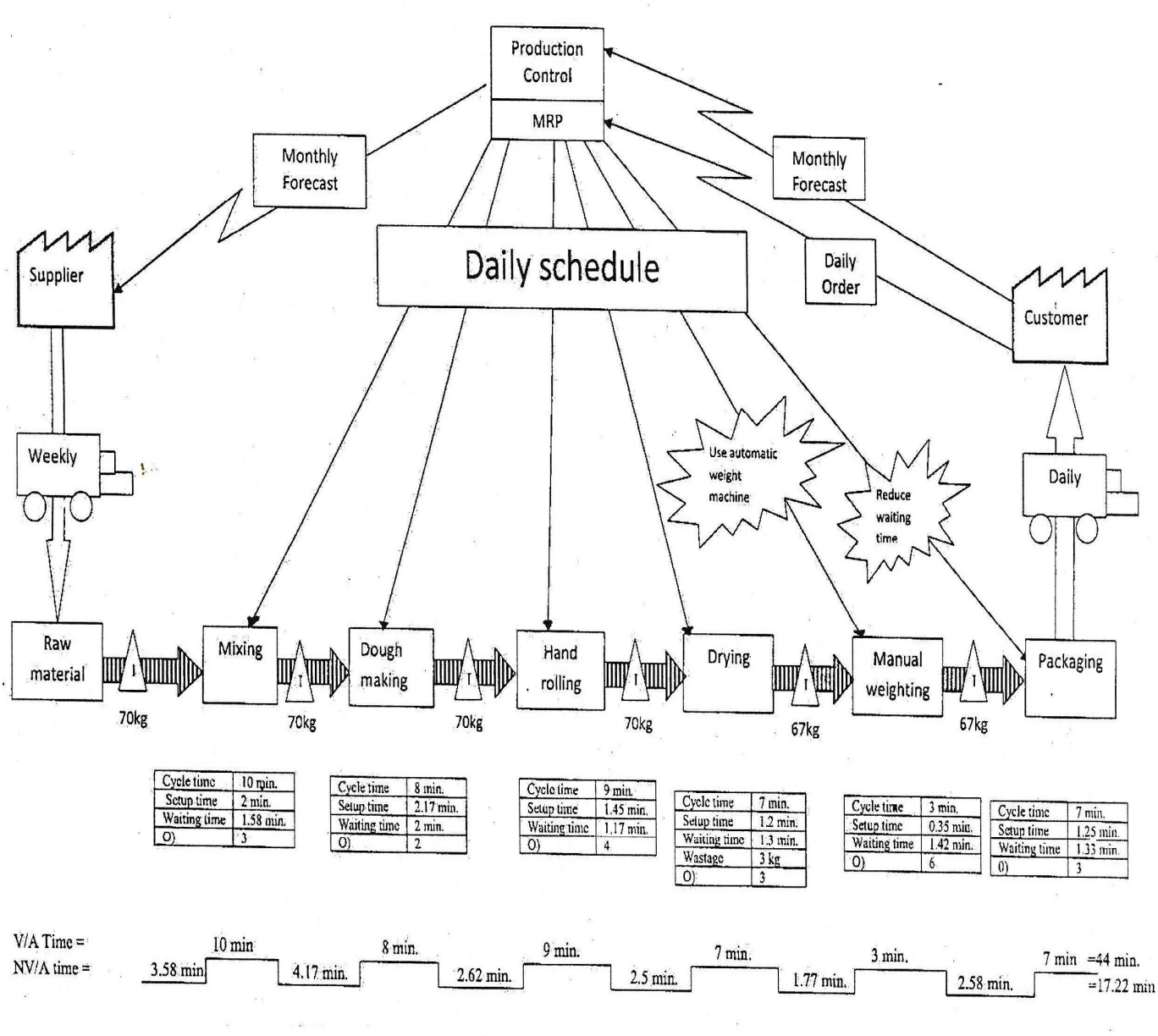

Fig. 3 Future state value stream mapping of Papad manufacturing

IV. RESULT & DISCUSSION

The Table 1 shows the reduction of cycle time, set up time and waiting time of Papad Manufacturing.

S. No.	Time (Activity)	Time taken in current state value stream mapping (min.)	Time taken in future state value stream mapping (min.)	Technique applied to reduce time	% Reduction of time
1.	Cycle time and set up time	10.4	3.35	Use automatic weight machine instead of manual weight machine.	67
2.	Waiting time	2	1.33	Reducing the gap between weighting and packaging process.	33

Table: 1. Reduction of cycle time, set up time and waiting time of papad manufacturing

V. CONCLUSIONS

Value stream mapping is a world class manufacturing tool that can be used to minimize waste in manufacturing. Waste reduction by using all kinds of VSM tools is the key concern regarding the process and productivity improvement.

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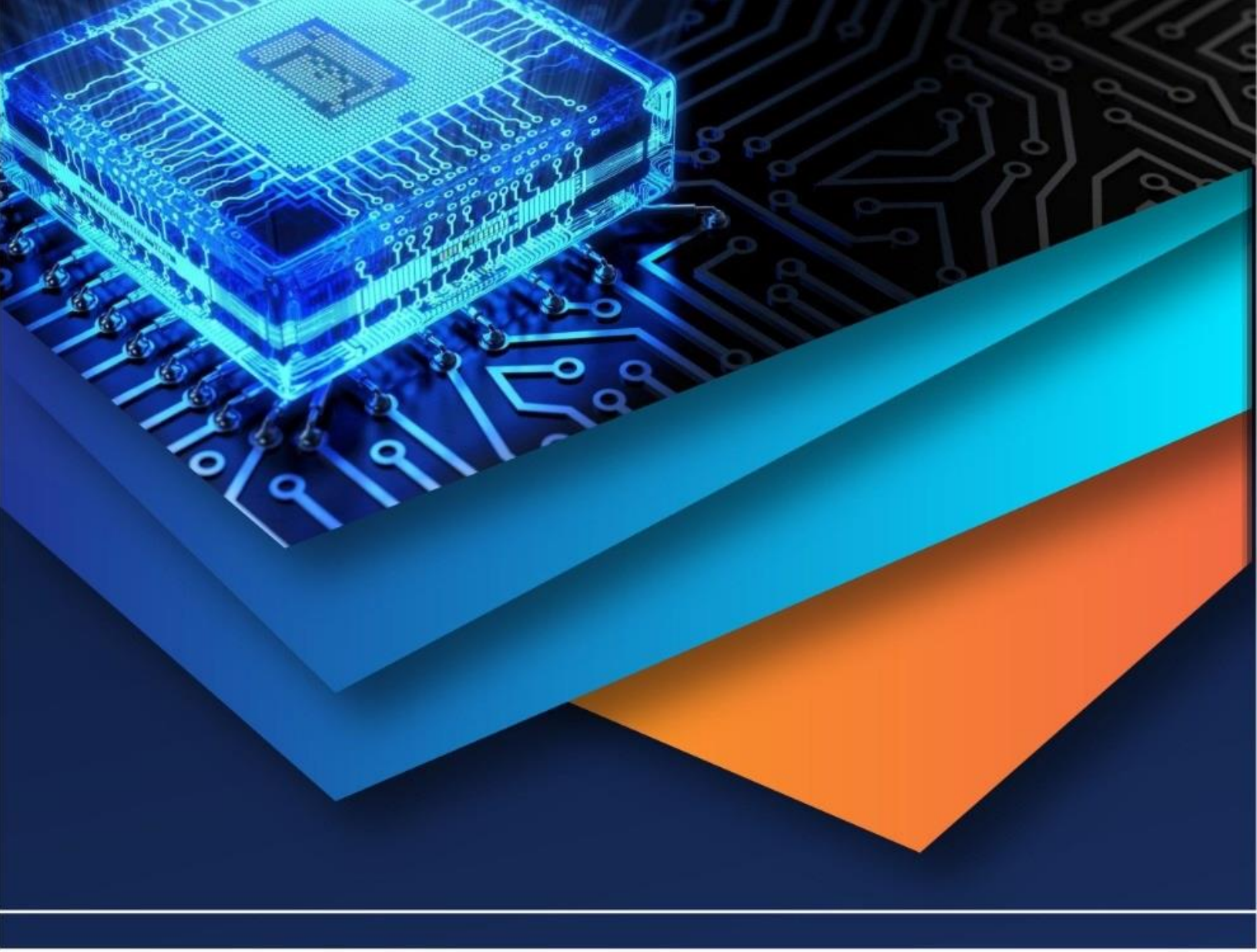

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