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The Study of Lean Method for Material Management in Construction Project by Time and Cost Analysis: Case Study at Kolhapur

Ms. Arpita Bharat Nikam[1], Mr. Satyajit B patil.[2]
[2]*Assistant Professor,* [1]*M.Tech Student, Department of civil engineering, Ashokrao Mane Group of Institution, Vathar tarf Vadgaon, Kolhapur*

Abstract: ***One approach for improving the current construction industry situation is using lean construction. Lean construction results from the application of a new form of production management to construction. Lean based tools have emerged and have been successfully applied to simple and complex construction projects. In general, lean construction projects are easier to manage, safer, completed sooner, and cost less and are of better quality. So, it is important to each and every where the lean material management should be used in construction project to reduce costs and time of construction project and increase the effectiveness. This study conduct one case study in Kolhapur where, consider one site on which we apply the lean material management. After that result obtain in the form of estimated cost vs. scheduled cost, estimated time vs. scheduled time. This result compare with traditional method which conduct in past. The lean result compare with traditional result and comparison are shown.***

Keywords: Material Management, Lean Construction, Construction waste, construction material, Construction Project.

I. INTRODUCTION

The productivity of the construction industry worldwide has been declining over the past years. Lean construction results from the application of a new form of production management to construction. Essential features of lean construction include a clear set of objectives for the delivery process, aimed at maximizing performance for the customer at the project level, concurrent design, construction, and the application of project control throughout the life cycle of the project from design to delivery. The Last Planner System technique, which is an important application of the lean construction concepts and methodologies and is more prevalent, proved that it could enhance the construction management practices in various aspects. Also, it is intended to develop methodology for process evaluation and define areas for improvement based on lean approach principles.

In proposed study approach included main study targeting purposively selected construction professionals respondent, in the Kolhapur city. First of all questionnaire was designed with the help of guide and experts in respective fields. Then responses are collected and respective objectives are obtained. From the questionnaire the factors affecting on lean material management application for Kolhapur city are find out. After that comparison between the traditional method and lean method take to find out the wastage of cost and time.

This study conduct one case study where, consider one site on which we apply the lean material management. After that result obtain in the form of estimated cost vs. scheduled cost, estimated time vs. scheduled time. This result compare with traditional method where the case study taken. The lean result compare with traditional result and comparison are shown. The new framework of Lean Material Management for Kolhapur is developed with reducing the factors which affected on implementation.

A. Lean Construction

A 'lean' system/ process/ organization is one that is waste free**.** Lean is not about size or number of people employed. A reduction in employees may cut costs, and eliminate the waste of those employees, but does not decrease the proportion of waste to value adding within the organization or process**.** Waste is through products waiting to be worked on by succeeding activities.

B. Techniques Available in Lean Material Management

1) *Visualization:* The increased visualization lean tool is about communicating key information effectively to the workforce through posting various signs and labels around the construction site. Workers can remember elements such as workflow, performance targets, and specific required actions if they visualize them. This includes signs related to safety, schedule, and

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quality. This tool is similar to the lean manufacturing tool, Visual Controls, which is a continuous improvement activity that relates to the process control.

2) *5 'S' Technique:* It helps to identify the location of material, equipment, and access, which reduced waste, such as search time for material and lay down spaces, and waiting time. This can be achieved by 5s process. It include sort, set in order, shine, standardize, sustain.
3) *Standard Work Method:* SWM is the Foundation of Lean. It is the safest, highest quality, and most efficient way known to perform a particular task and process. It is the only acceptable way to do the task and process which should be continually improved. It includes three critical elements that are customer demand. SWM includes following steps :-Define start and end points of the process, Determine appropriate standard work, Gather required information, Create standard work documents, train the supervisor, Train employees, Run the process and observe results
4) *7 Wastage Method:* The things produced more than necessity are nothing but wastes; the main of lean is to reduce waste.So it is necessary to reduce waste produced due to defects, overproduction, transportation, movement, waiting, overproduction, inventory etc. Non value added work

C. Last Planner System

Last planner system is combination of all methods discussed above. It includes all the point in all above methods. So lean material management doing on site by mostly using Last Planner System, which discussed deeply in below.

1) *Last Planner System:* The Last Planner System used for Planning and mutual coordination. The Last Planner System (LPS), the main tool of Lean Construction, is a collaborative planning tool facilitating communication, participation and which take into consideration the constraints of each stakeholder. The last planner system is in simple word it is the combination of all above mentioned tools. It has the main objectives such as manage and mitigate the variability, the completed assignments should be checked, causes to failure to complete the planned work should be investigated and removed etc. Last Planner System (LPS) aims to shift the focus of control from the workers to the flow of work that links them together. The two main objectives of LPS are to make better assignments to direct workers through continuous learning and corrective action and to cause the work to flow across production units in the best achievable sequence and rate.

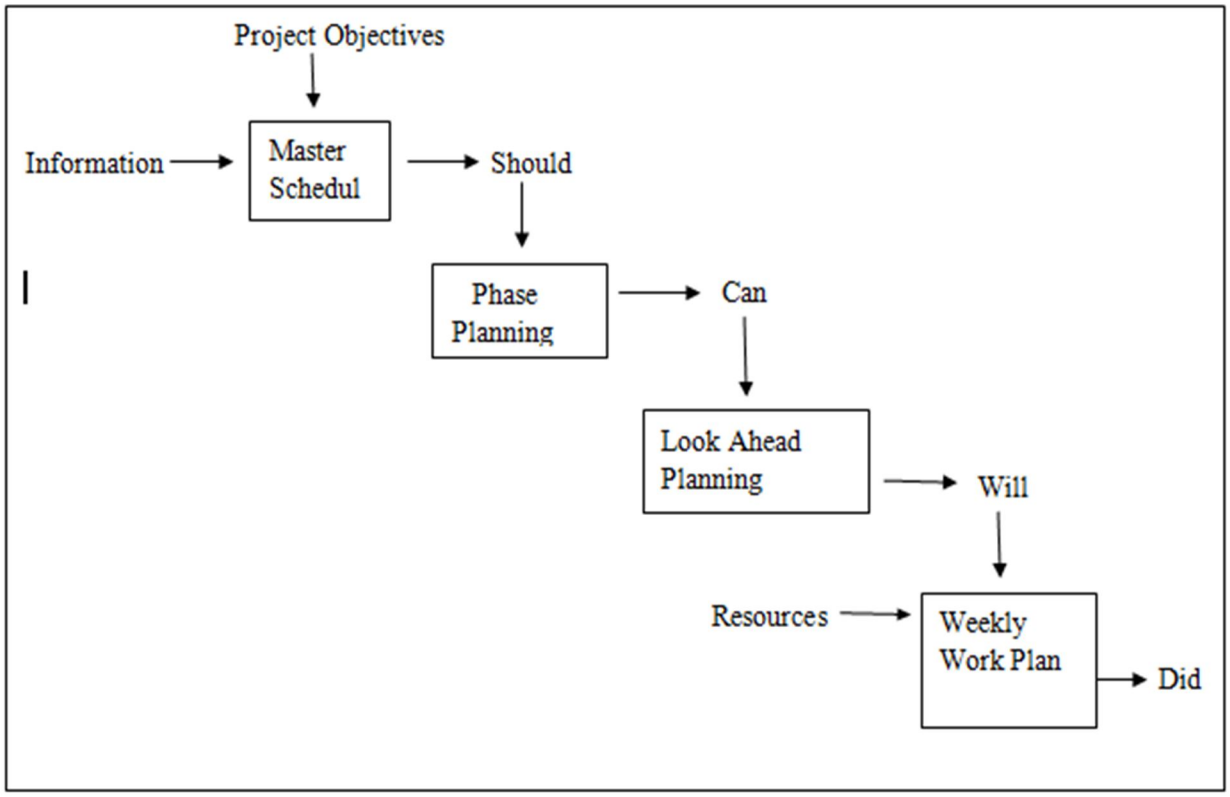


Fig. 1 Last Planner System

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II. METHODOLOGY

This chapter describes the methodology that has been adapted in the present thesis. The study will be carried out in Kolhapur, Maharashtra as per availability of data and sites. First of the entire all literature related to the lean material management are studied. Which explain the lean and its various techniques. After that one of the most important techniques is selected. Then it is implemented on the site which gives the result. Then the conclusion and necessary recommendation are given.

LITERATURE REVIEW
⇩
IMPLIMENTATIONS
⇩
RESULTS AND DISCUSSIONS
⇩
CONCLUSIONS AND
RECOMMENDATIONS

Fig.2 research Methodology

III. IMPLIMENTATION

In this chapter we are discussed that most using method of lean that is Last Planner System which is how apply on the Kolhapur city, and the factors affecting on that calculated, how to minimize them by developing new frame work of lean material management for Kolhapur city .

A. Case study for Traditional Material Management

To compare the lean material Management with traditional material management, we take one construction site for the same company under which we work out lean material management.

1) *Details OF Site:* The Construction site where the traditional material management was conducted are given below, it is residential building of G+1 of 3291.31 sq.ft. Total built up area.

1	PROJECT TYPE	Residential project (G+1)
2	SCHEDULED COST	4282628.94
3	ACTUAL COST	4531452.60
4	SCHEDULED DAYS	500
5	ACTUAL DAYS	570

Table No. 1 Traditional material management

B. Case study for lean material management

The Construction site taken for the application of Last Planner System are given below, it is residential building of G+1 of 800.875 sq.ft plot area with 1601.75 sq.ft total built up area. Here the last planner system was used.It is the first step of Last Planner System. “Master Schedule” is used to determine crudely the main actors, the sequences of building as well as the milestones which should be accomplished during the step “Phase planning”.In our project the main objectives of the project are that here we find out are complete the project within our decided time and cost. Also the process we defined in LPS that is phase planning to weekly work plan is completed as per decided in the master plan. Second one is Phase Planning. During the phase planning proper estimation of cost and time is doing which is very important it affect on the whole work. For that expert are arranged during the phase planning process. On this site the total work is divided into total 16 phases. Work divided into Foundation to Door, Window placing work. During the completion of phase of foundation, before the last 2 weeks we are doing the Look Ahead Planning. In which we are arranged on meeting where we discussed for future upcoming phase and placed order for that before 1 to 2 days of completion of current phase. Means after completion of footing phase time is not wasted to wait for next material. After that there is weekely work plan. “Weekly Work Plan” is a weekly schedule containing only the tasks without constraints so all stakeholders become responsible and engaged on the activities that will be executed the next week (promises).

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SR. NO	CATEGORY	PHASE NO	CONTENT	ACTUAL TIME(DAYS)	SCHEDULED TIME (DAYS)	COST
1	Line out			5	5	19610
2	Ground Floor	1	Foundation	30	32	131250
		2	Column	25	28	71500
		3	Beam	25	30	88800
		4	Slab	31	30	165500
		5	Staircase	5	6	60700
		6	Brickwork	12	15	74750
		7	Plasterwork	12	15	64500
3	First Floor	8	Column	22	28	71500
		9	Beam	25	25	88800
		10	Slab	31	30	165500
		11	Staircase	5	5	60700
		12	Brickwork(including chajja work)	12	14	154750
		13	Plasterwork	12	15	64500
4.	Parapet Wall	14		6	8	64250
4.	Tile Placing	15		25	35	184882
5.	Door, Window placing	16		4	6	181680
Total				287	327	

Table No 2 Lean material management with cost and time

1) Hence, from the all calculation the observation obtained are given below,
2) The total cost (plumbing, elevation, electrification) of construction as per lean construction = 1918752.64/-
3) The total cost of construction as per schedule = 2237670.79/-
4) The scheduled days as per traditional method = 327 days
5) The days required as per lean construction are = 287 days

IV. RESULT

It will show the cost and time comparison of lean material management and traditional material management.

1) *Cost Comparison*: Cost comparison shown between Traditional Method Lean Method and The reasons responsible for that are also shown below

Cost	Traditional Method (TMM)	Lean Method
Schedule Cost	4282628.94	2237670.79
Actual Cost	4531452.6	1918752.64
Reasons	In TMM the Actual cost was more than scheduled cost. Due to the improper estimation, scheduling. Improper planning, Poor management control, Shortage of resources, Lack of team work.	In LMM the Actual cost was less than scheduled cost. Due the proper scheduling and estimation, Proper phase planning, management control till the end.

Table No 3 Cost comparison between TMM and LMM

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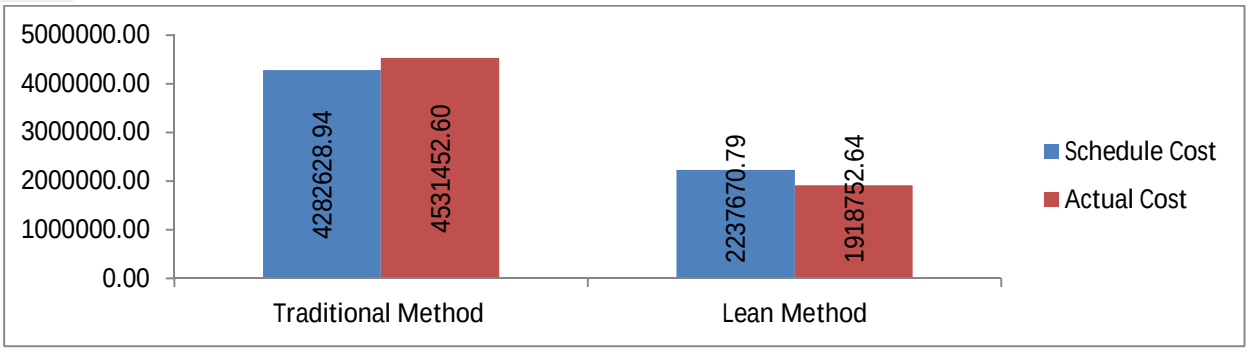


Fig.No.3: Cost comparison between TMM and LMM

2) *Time Comparison:* Time comparison shown between Traditional Method Lean Method and The reasons responsible for that are also shown below,

Days	Traditional Method (TMM)	Lean Method(LMM)
Schedule Days	500	327
Actual Days	570	287
Reasons	In TMM actual days required to complete the project are more than the scheduled days because of late delivery time, improper estimation and scheduling, rework, shortage of material.	In LMM actual days required to complete are less than scheduled days because of proper phase planning, good management control clear vision and mission, proper look ahead planning,

Table No 4 Time comparison between TMM and LMM

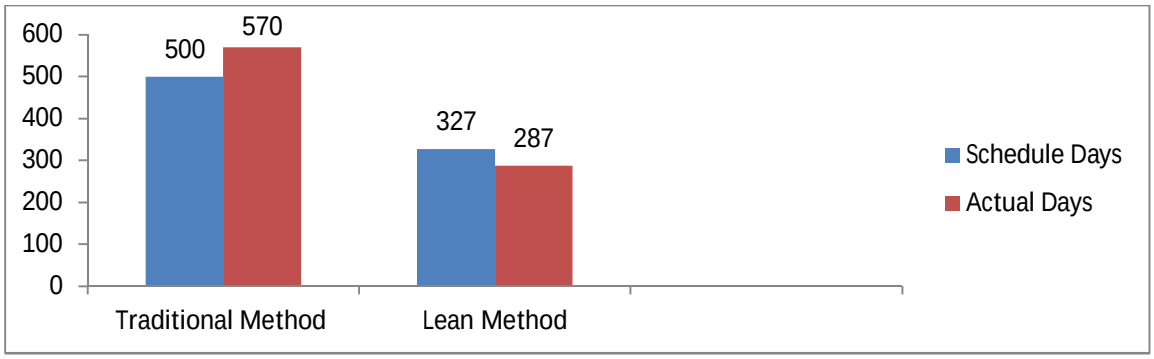


Fig.No.4: Time comparison between TMM and LMM

V. CONCLUSION

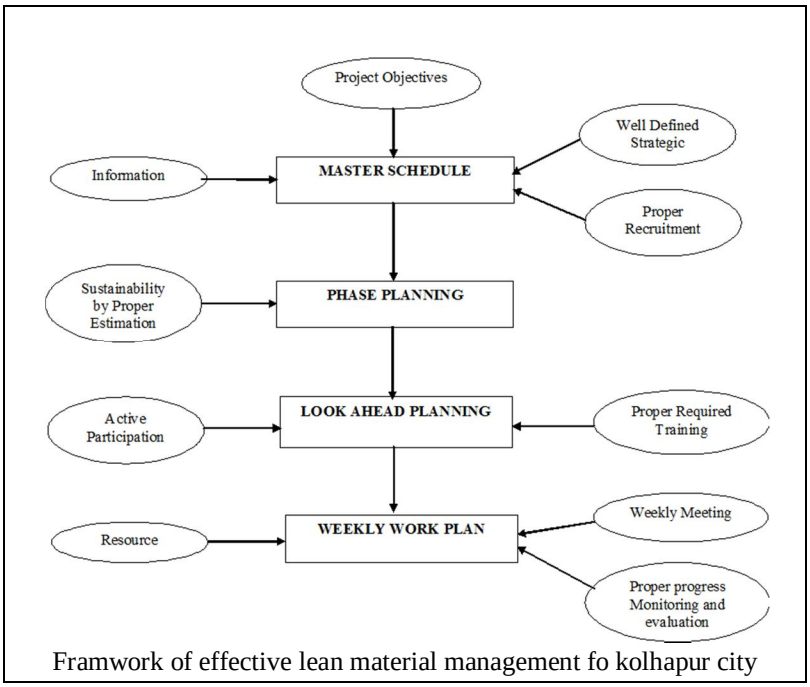
The learning outcome from the study , here we give the solution on the factor which are affect on lean material management for Kolhapur city and design new frame work for Kolhapur city which is the main aim. The solution given on traditional material management which is lean is effectively successful which reduce the cost and time wastage which is the important. The study can be extended to find out various types of construction waste been produced in construction industries and to implement various types of lean techniques in order to minimize waste and decrease the impact of waste on Cost, Quality and Time.

After studying the it was concluded that

A. Application of last planner system gives better results as compare to traditional construction management on case study.
B. It saving of 12.23% and 14% in time and cost respectively.
C. Saving cost 318918.15 Rs. after the application of LPS.
D. Last planner system is more effective than the traditional management system.

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The frame work used in lean material management for Kolhapur city was,



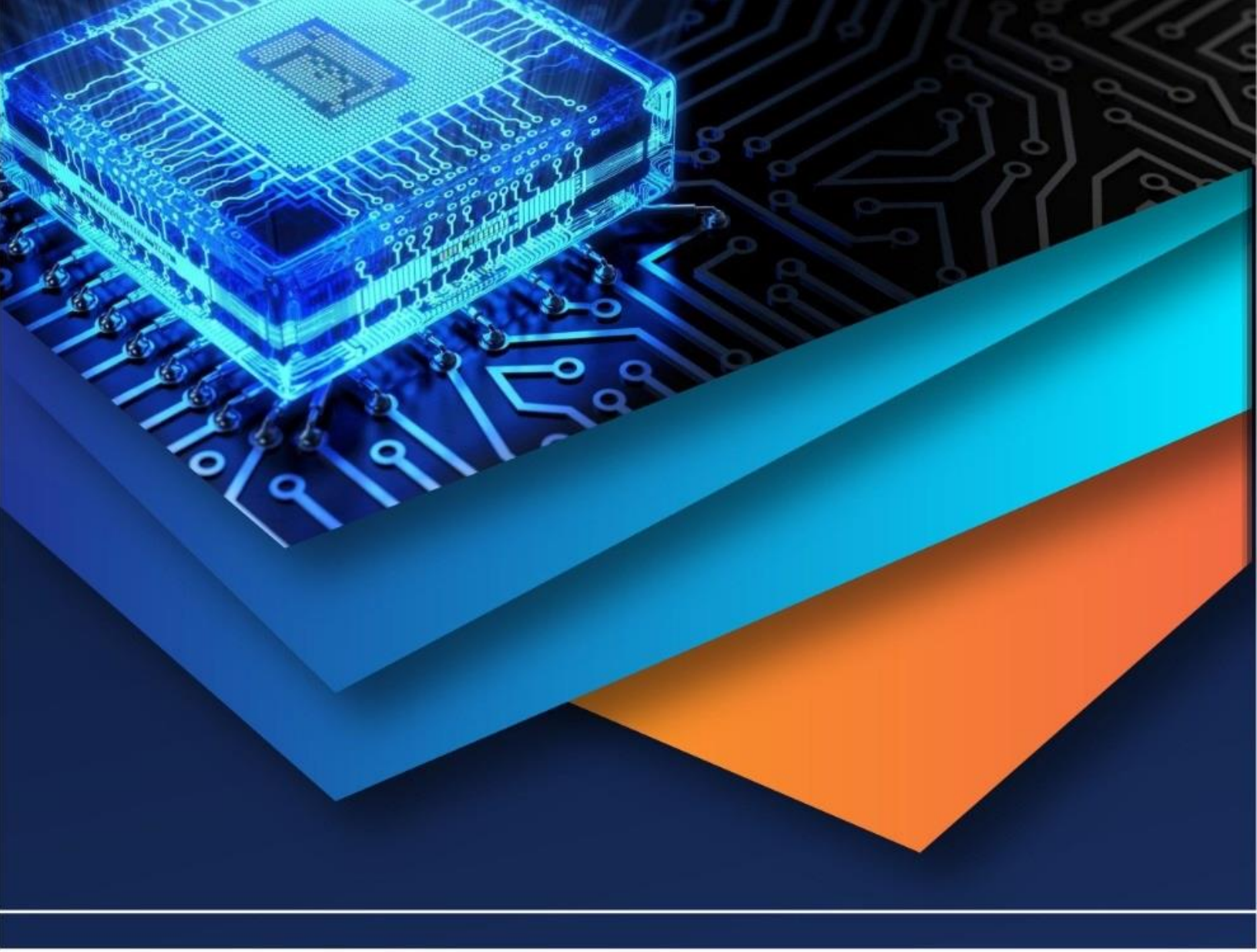
Framwork of effective lean material management fo kolhapur city

Table No 5 Framework of effective material management for Kolhapur city

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