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Assessment of Productivity Constraints in Building Construction Industry

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Abstract: ***Construction management deals with planning, organizing, securing and managing resources to bring out the successful completion of specific engineering project goal and objectives. Assessment of productivity in construction industries includes identifying the key constraints to on site labor productivity and improvement measures.This study aims to identify the key constraints to on-site labour productivity and improvement measures. Using the descriptive survey method, views of some project managers, contractors and subcontractors in Kolhapur was canvassed via pilot interviews and questionnaire surveys at the qualitative and quantitative data gathering stages, respectively. Multi-attribute technique was used to analyse the quantitative data. Results showed that the key external constraints to on-site labour productivity comprise, in order of decreasing impact, statutory compliance, unforeseen events and wider external dynamics. The internal constraints were found to have much higher impact on onsite productivity than the external factors. In order of diminishing levels of impact, the internal constraints comprise reworks, level of skill and experience of the workforce, adequacy of method of construction, buildability issues, and inadequate supervision and coordination.The factors underlying each broad category of external and internal constraints are reported. The relative levels of impact of the identified constraints are expected to guide the project team in addressing the constraints in a cost-effective manner.***

Keywords: Construction management, Labour productivity, Performance improvement, Productivity constraints.

I. INTRODUCTION

The construction industry is a sector of the economy that transforms various resources into constructed physical economic and social infrastructure necessary for socio-economic development. It embraces the process by which the said physical infrastructure are planned, designed, procured, constructed or produced, altered, repaired, maintained, and demolished. Productivity is one of the important components of every company's success and competitiveness in the market. The concept of productivity is related to the quality of input, output and process. Productivity helps to achieve cost savings and profit. A productive industry may also be profitable which allows growth and innovation and have a positive effect on the society. The profit or loss of a construction contractor depends upon the company's productivity which responds to market competition. Productivity enables a company to be competitive, set goals, and meet stack holder and financial health. At an industry level, productivity enables to maintain satisfied client, attractive investments and contribute to the economic growth. Improvement in the productivity of the construction industry hence, is a important and critical aspect.

II. PRODUCTIVITY IN CONTEXT

Productivity is a complex concept that could be interpreted in varied contexts depending on the objectives sought; the objectives in turn determine the parameters involved in its assessment in relation to the benchmark used for its comparison. This is a definition that fits well with different perspectives; it emphasizes creativity and innovation, which target achieving more outputs with less resource inputs by re-engineering the production or service delivery process and optimising the resource leverage. The benchmark for comparison is critically important because productivity outcome in itself is meaningless except if it can be compared with a benchmark. The comparison could be intra-entity - i.e. comparing productivity outcomes within a given entity across a time period with a view to gaining insights into the implicit trend. It could also be inter-entities - i.e. comparing productivity outcomes across similar entities with a view to determining the relative levels of productivity of the entities at a snapshot or across a time horizon.
The objectives to be achieved, the resources employed, the measures adopted and the benchmarks used for comparison give rise to different definitions of or perspectives on productivity. The common threads in all definitions or contextual interpretations of productivity relate to:

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1) *Effectiveness:* i.e. how effective is the leveraging of the resources to achieve the set objectives? E.g. a system can be adjudged productive in effectiveness context, if the set objectives are achieved through effective resource leverage;
2) *Efficiency:* i.e. in achieving the set objectives, how efficient was the utilization of the scarce resources in the implementation process?

Overall, an operational definition of productivity that fits well with the various approaches to defining the concept - which draws upon the output-input paradigm - is the amount or quantity of output of a process per unit of resource input.

$$\text{Productivity} = \frac{\text{Output}}{\text{Resource input}}$$

Where: Output could be in units or dollar value of product or service, revenue generated or value added; resource input could be in units or dollar value relating to manpower (i.e. man-hour), machinery (i.e. machine hour), materials (i.e. quantity), or money (i.e. dollar value).

The nature of the resource input or a combination of inputs also informs the type of productivity and the measures used to evaluate it as shown in Equation 1. The two most common types of productivity are the single-factor and multi-factor productivity; the former considers only one of the resource inputs as the denominator to Equation 1, while the latter considers all resource inputs for a more holistic perspective.

III. RESEARCH METHOD

The study relied on experienced-based feedback in Building construction Industry Kolhapur on the key on-site productivity constraints from those at the forefront of project implementation – the structural consultants, contractors, builders, architect – as the source of the primary data. The descriptive survey was therefore chosen as the most appropriate research method. This involved the use of pilot interviews and questionnaire surveys at the qualitative and quantitative data gathering stages, respectively. The questionnaire was filled by the structural consultants, contractors, builders, architect.

The ten to fifteen minute response to the survey involved rating the constructs using a five-point Likert scale, but with provision for further inputs on additional constructs which were not included in any given subset.

A. Key Constraints to Onsite Labour Productivity in Building Construction Industry, Kolhapur

At the questioner survey of 40 Building construction firms , the constraints mentioned by the interviewees as key constraints to onsite labour productivity in the building construction industry, Kolhapur. construction were classified under broad categories as finance, project, human resources, automisation, safety, on-site, disaster, socio-economic, time, miscellaneous, each comprise of five broad categories viz.

FINANCE

Frequent rework.
Late payment of wages.
Poor estimation.
Diversion of funds.
Varying interest rates.

PROJECT

Hiring a PMC.
Frequent changes in design.
Delay in decision making.
Poor planning.
Incomplete instructions.

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HUMAN RESOURCES

Lack of experience.
Over manning.
Absenteeism.
Low team work.
Alcholism.

AUTOMISATION

Lack of specific tools for specific works.
Inadequate accomodation.
Internal network of approach & utilities.
Construction equiment breakdown.
Material storage location.

SAFETY

Accidents.
Poor awareness.
Safety precautions not taken.
Medical care not available.
Insufficient lighting.

ON-SITE

Poor site condition.
Inadequate transportation facility for workers.
Work in unreasonable sequence.
Late delivery of drawing.
Quality supervision.

DISASTER

Change in weather.
Natural disaster.
Man-made disaster.
Lack of awareness of disaster.
Poor planning for emergency.

SOCIO-ECONOMIC

Appreciation of work.
Energy crises.
Implementation of Govt.laws
Inflation.
Communication.

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TIME

Waiting idle of labour, equipment.

Labour slow down.

Working overtime.

Time pressure.

Inefficient work hours.

MISCELLANEOUS

Lack of co-ordination.

Procurement method.

Complications in project.

Lack of innovation.

Faulty materials.

IV. DATA ANALYSIS

The multi-attribute analytical technique was used to analyse the highest MR value representative rating point for the collective ratings made for each variable in the subset. Equation shows the computation for the MR

$$MR_j = \sum_{k=1}^{5} (R_{p_{jki}} \times \%R_{jk})$$

Where:

MRj = Mean Rating for constraint factor *j*;

Rpjk = Rating point *k* (ranging from 1- 5);

%Rjk = Percentage response to rating point *k*, for constraint factor *j*.

A. Level of Significance of the Constraint Factors

Based on the MR values, the most significant constraint factor in a subset is one with the highest MR value. The constraint factor having an average or higher level of impact on onsite labour productivity is considered significant.

Significant constraint factor: MR > 2.5 (3)

Non-significant constraint factor: MR < 2.5 (4)

Where: 1 < MR < 5 on a rescaled 5-point Likert rating scale.

It should be noted that the middle of the 5-point Likert scale is 3. However, on a transformed interval scale used in the computations, 2.5

is the lower end of the re-scaled middle band hence its use as the threshold of significance.

V. RESULT AND CONCLUSION

As per the questioner survey of the 40 Building construction firms in Kolhapur, the key constraints are

A. Finance

Late payment of wages is the major factor Having 5 Likert scale which will impact on the productivity in building construction industry Diversion of funds is rated as 4 Likert scale by the Experts or the interviews so it also has a great impact on the productivity in building construction industry.

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B. Project

Hiring a PMC will have a positive impact on the productivity in building construction industry. Delay in Decision making has a major impact having 3 Likert scale.

C. Human Resources

Lack of Experience and low team work have a great impact having 3.5 Likert scale

D. Atomisation

Lack of specific tools, internal network of approach and utility have 3 Likert scale effect on the productivity in building construction industry.

E. Safety

Safety precaution not taken and medical care not available have 4.5 Likert scale on the impact on the productivity in building construction industry.

F. On Site

Poor sight condition, inadequate transportation capacity for workers has 4 Likert scale on the impact on the productivity in building construction industry.

Let Delivery of Drawing has 3 Likert scale on the impact on the productivity in building construction industry.

G. Disaster

Natural disaster has 4 Likert scale on the impact on the productivity in building construction industry. Poor planning for emergency has 4.5 Likert scale on the impact on the productivity in building construction industry.

H. Socio Economic

Appreciation of work has 3 Likert scale on the impact on the productivity in building construction industry. Energy crises and communication has 2.5 Likert scale on the impact on the productivity in building construction industry.

I. Time

Waiting idle of labour, equipment, working over time has 4 Likert scale on the impact on the productivity in building construction industry.

J. Miscellaneous

Procurement method and complication in project have 4 Likert scale on the impact on the productivity in building construction industry. To improve the Building construction productivity the key constraints should be considered. The other factors which has less impact Likert scale on the impact on the productivity in building construction industry are alcoholism, changes in design, time pressure, quality supervision.

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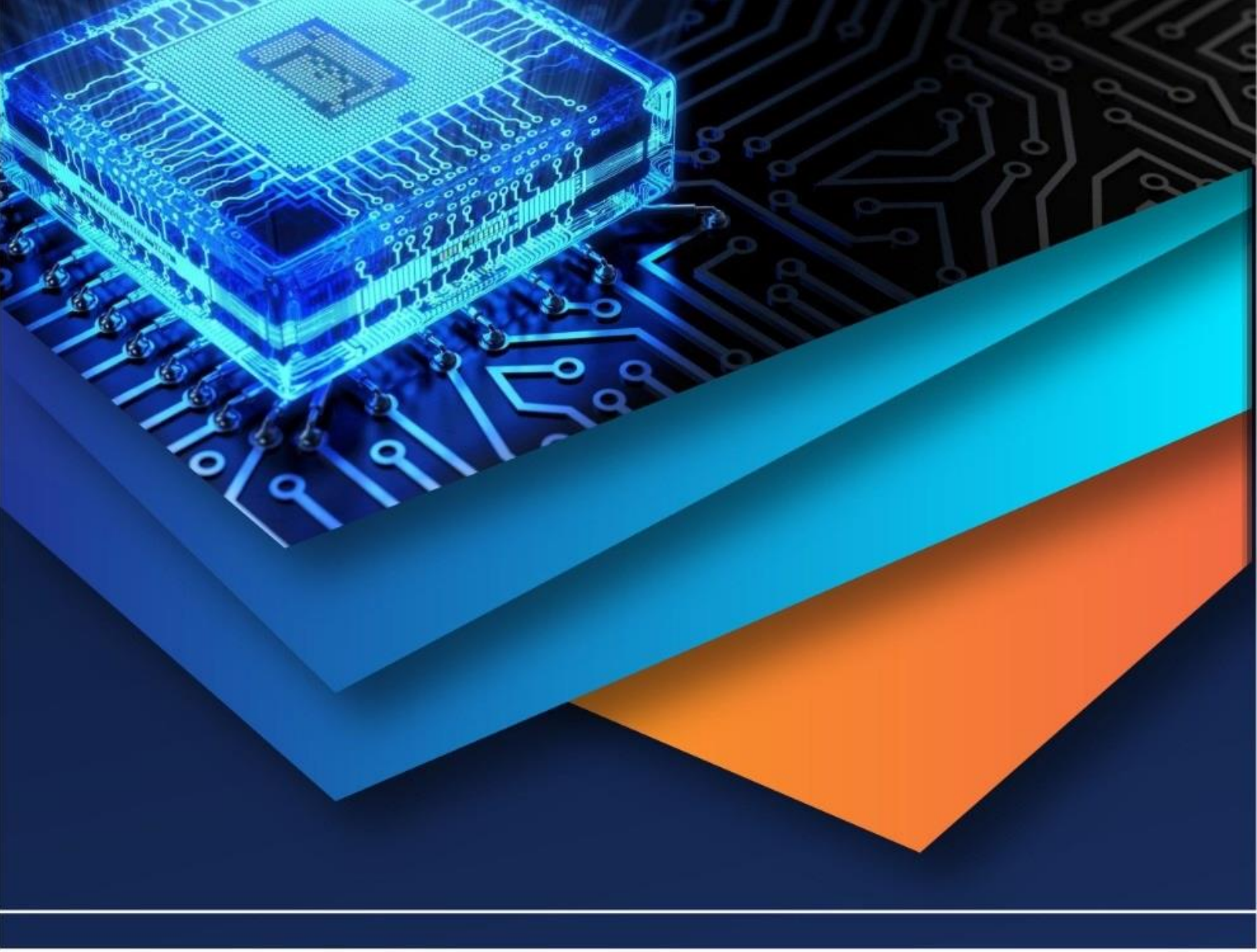

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