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Controlling the Project Cost in Construction Sector by Developing Management System: Wastage Analysis by Using Earned Value Management

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Abstract— In construction sector, construction material impacts overall cost of project to the great extent. Management of cost control is extremely important by implying different management technique at micro-level of project activities. Due to the various constrain, material cost is increasing day by day, which adversely affects project budget cost. Construction sector is growing widely, especially large quantum projects. These projects require huge quantity of variety material. Use of traditional method might results in excess quantity of ordered material resulting in decreased profitability of project. Application of wastage analysis of material by using Earned Value Management helps to minimize the wastage of material. Excess ordering of material results in unnecessary capital expenditure causing problem to the smooth cash flow. Material cost can be up to 60-70% of total cost of project. In this study, Retail fitout store is considered for comparison between traditional material procurement and procurement after performing wastage analysis.

Keywords—construction: Budgeting: Costestimate: wastage analysis: cost.

I. INTRODUCTION

Material, Manpower, Money and Machines are the important factors in any construction work. Material plays a crucial role in the overall cost of a project. Material wastage is a big problem in construction. Although practically it is impossible to avoid waste completely through proper planning and management techniques, we can minimize it to a great extent. Construction waste not only impacts project profitability but also affects the environment. Since construction waste contains a high level of contamination, it is very difficult to recycle. In this study, the Budget cost is considered as a primary factor. Depending upon the level of determination of work, the accuracy of the total budget depends. Once the clear scope is decided, the final budgeted cost is prepared. Accordingly, material is ordered at site.

30% of the waste generated in global was originated from construction and demolition of buildings. Different materials are used in construction sites depending on the categorization as structural or non-structural work. It was observed that when the material usage is high, the generated waste is also at a higher rate at most of the construction sites. Wastage analysis is essential for construction project since construction involves huge cost, heavy machineries are involved and project can be stuck midway. Practically or impractically this affect the manpower working on site. Cost estimation in preconstruction stage helps to minimize this problem.

A cost estimate is the approximation of the cost of a program, project, or operation. The cost estimate is the product of the cost estimating process. The cost estimate has a single total value and may have identifiable component values.

II. METHODOLOGY

- A. Data is collected through site visit
- B. Wastage data analysis done on collected data.
- C. Find precautionary measures for the problem.



III. LITERATURE REVIEW

A waste can be define as unwanted part of the material used while construction. It may be due to the inefficiency of machine or manpower. In many times this wastage is due to the storage and handling of the material. Following terms will helps to explain the research. Process of cost control in the flow of cost estimation. cost budgeting and cost control.

A. Cost Estimation

A cost estimate is the approximation of the cost of a program, project, or operation. The cost estimate is the product of the cost estimating process. The cost estimate has a single total value and may have identifiable component values.

B. Cost Budgeting

It is a tool to estimate the costs or necessary efforts for projects, work packages or activities in project management. Cost budgeting includes the estimation of costs, setting a fixed budget, and managing and controlling the actual costs (compared to the estimated ones). The costs then have to be allocated to the activities or work packages in a project. A carefully implemented schedule and resource plan enables a more precise cost budgeting.

C. Cost Control

It is the practice of identifying and reducing business expenses to increase profits, and it starts with the budgeting process. A business owner compares actual results to the budget expectations, and if actual costs are higher than planned, management takes action.

D. EVM

It is a project performance measurement technique that integrates scope, time, and cost data.

E. Planned Value (PV)

PV, formerly called the budgeted cost of work scheduled (BCWS), also called the budget, is that portion of the approved total cost estimate planned to be spent on an activity during a given period

F. Actual Cost (AC),

AC, formerly called actual cost of work performed (ACWP), is the total of direct and indirect costs incurred in accomplishing work on an activity during a given period

G. Earned Value (EV),

EV, formerly called the budgeted cost of work performed (BCWP), is an estimate of the value of the physical work actually completed.

H. Procedure for Wastage Analysis

1) *Step 1:* Estimation of building material at preconstruction stage assuming all the scope clearance and final drawings are received.

2) *Step 2:* After the completion of details estimate, arrange the activities in descending order with respect to the cost..From the data collected from site, we have encountered following five activities.

SR. NO.	DESCRIPTION	UNIT	EXECUTED QTY	AMOUNT
1	ACP Panel	SQM	182.69	3,74,256
2	Rolling shutter	SQM	159.71	4,27,258
3	Plywood installation	SQM	217.31	4,16,955
4	AAC blockwork	M3	28.03	2,82,388
5	Steel sections	MT	1.68	1,47,250

3) *Step 3:* Executed quantity (calculated at preconstruction stage) is considered with material ordered by vendor as per traditional method. (Without computing wastage analysis)

SR. NO.	DESCRIPTION	EXECUTED QTY	Ordered Qty	Unit of QTY ordered
1	ACP Panel	182.69	73.00	Nos
2	Rolling shutter	159.71	159.71	SQM
3	Plywood installation	217.31	100.00	Nos
4	AAC blockwork	28.03	2,000.00	Nos
5	Steel sections	1.68	1.90	MT

4) *Steps 4:* Considering the executed quantity, wastage analysis is calculated. For that quantity of material is calculated as per following formula.

$$\text{Wastage Analysis Quantity of material} = \frac{\text{Executed Quantity}}{\text{Size of single item}}$$

*Standard quantity estimation method should be used.

*Ordered quantity collected from onsite material challans.

*10% wastage quantity is considered while calculating wastage analysis quantity.

SR. NO.	DESCRIPTION	Unit of QTY ordered	Ordered Qty	Quantity after wastage analysis
1	ACP Panel	Nos	73.00	67.66
2	Rolling shutter	SQM	159.71	159.71
3	Plywood installation	Nos	100.00	80.48
4	AAC blockwork	Nos	2,000.00	1,541.70
5	Steel sections	MT	1.90	1.764

5) *Step 5:* After Analysing data from step 4, we can conclude that excess quantity is order for four material out of five. Hence wastage analysis is essential for any construction project.

SR. NO.	DESCRIPTION	Ordered Qty	Quantity after wastage analysis	Excess quantity ordered
1	ACP Panel	73.00	67.66	YES
2	Rolling shutter	159.71	159.71	NO
3	Plywood installation	100.00	80.48	YES
4	AAC blockwork	2,000.00	1,541.70	YES
5	Steel sections	1.90	1.764	YES

Excess material involves large capital investment and it results as a problem for material storage and material handling.

IV. RESULTS AND DISCUSSION

After performing this study, it can be conclude that material wise wastage analysis can save considerable capital of project. Generally vendor or sub-contractors are tend to order the material as per their past experience, resulting in procurement of excess quantity. With the help of wastage analysis, project manager can get idea regarding actual quantity requirement. This



also helps to identify long lead items and order them in prior as per site requirement. Depending upon the site demand, partial or complete material can be ordered.

The primary control measures:

- Dedicated supervisor should be allot for waste control.
- Strategic material procurement as per wastage analysis.
- Create awareness among the worker and subcontractor regarding wastage impact on the environment.
- Incentive system should be implemented.
- Pre-Fabricated material should be preferred as it saves time and material.
- Constant innovation to be done on site level to manage wastage.
- Mix proportion material like plaster and concrete should monitor at micro-level to avoid wastage.

V. CONCLUSION

The proper management and planning of material helps in lesser waste generation at site. Estimating quantity at preconstruction stage helps to procure material in right quantity. Ultimately it reduces material wastage and increases project profitability. Procurement done by traditional method caused excess material dump at site where as material procure after performing wastage analysis, adequate quantity of material is available at site. This results into less capital investment which is good for positive cash flow. It also helps the management to make proper valuations of inventory (viz., Work-in- progress and finished products). It also helps the management to take various corrective decisions viz., fixation of price, make-or-buy decisions etc. which will be more beneficial to the firm. It also helps the management to supply necessary data relating to cost element to submit quotations or to fix up the selling price of a firm.

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