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## PEC APPROACH FOR IMPROVING PROFITABILITY IN SMALL AND MEDIUM CONSTRUCTION FIRMS IN INDIA

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**Abstract:** The productivity level of construction industry is mostly depending upon three factors labour characteristics, management systems/software and external issues. Different researchers have determined different factors that impact construction productivity. Understanding the level of productivity, it is important to develop innovative practices and techniques to improve construction productivity. In this work comparison of proposed approach with traditional approach in terms of Planning, controlling and execution has been done. In this work Autodesk take off is used for Planning, primavera is used for Execution and Buildtrend is used for Control. The paper gives review on different method which is used for measurement of construction productivity, factors affecting and theories on improvement of construction productivity such as labour factor, management factors and external factors, the paper further reviews different innovations which are made for improvement in construction productivity. It is observed that there are lot of different methods and strategies for improvement of construction productivity but they differ from site conditions and the factors which influence construction productivity. In this paper evaluation of latest and traditional approach for G+9 and G+6 residential building has been done.

**Index Terms - Labor Productivity, Construction Management, Software, Materials Management, Safety, Primavera Approach.**

### I. INTRODUCTION

Construction industry is world's most largest and challenging industry in India. The construction projects are mostly labour based with basic use of hand tools and equipment in which labour cost consists of about 30% to 50% of total project cost [1] Indian construction industry is one of fastest growing sector globally. India shares about 8% of total GDP and also provides employment to around 35 million peoples directly or indirectly [2]. In construction industry one of the biggest problems faced is of unskilled labour which implies in efficiency loss and effects on cost overrun and schedule every day. Labour productivity is significant factor which affects physical development of construction project.

### II. OBJECTIVES

1. To implement qualitative approach over conventional approach on different firms.
2. To apply standard project plan. (planning-execution-control) PEC Approach.
3. To monitor and enhance the quality of work,
4. To assure effect of Brand value and maximize profitability.

### III. METHODOLOGY

The crucial consider prosperous implementation of a construction project not solely depends on the standard & amount of labor, however conjointly for the most part depends on handiness of resources. All activities concerned within the project need certain quantity of resources. Every activity is allotted with a particular resource and should be completed among the point in time; otherwise it should adversely have an effect on the length of the project. The time and value area unit directly captivated with the provision of resources. The time needed is also determined by dividing the productivity related to the resources used on the activity into the outlined amount of labor for the activity. The most effective combination of resources to use for a construction activity relies on contractor's ability to spot the interdependencies of the assorted resources.

This study introduces a comprehensive framework for resource management notably associated with work force as resource component in construction domain. In this study Resource constrained Approach and Primavera approach for project management has been used. This study basically deals with little and medium Indian housing industry corporations'. the study deals with basic three components of construction project viz: Coming up, Execution and Management. In this study comparison of website

victimization ancient approach and proposed resource unnatural approach for a construction site situated at Pune region, Maharashtra has been done.

During this study Autodesk set out is employed for coming up with, primavera is employed for Execution and Build trend is employed for management.

### 3.1 PLANNING-EXECUTION-CONTROL APPROACH (PEC).

#### 1. Autodesk takeoff

Autodesk Takeoff building price estimating software system helps build material cost accounting quicker, easier, and a lot of correct. price estimators will produce synchronic, comprehensive project views that mix necessary info from building info modeling (BIM) tools like Revit® design, Revit® Structure, and Revit® MEP software system beside pure mathematics, images, and knowledge from different tools. Mechanically or manually live areas and count building parts, export to Microsoft® Excel®, and publish to DWF™ format.

#### FEATURES

1. Takeoff in minutes mechanically
2. Perform a takeoff on a whole building info model (BIM) in precisely minutes through integration of 2d and 3D style knowledge.
3. bigger flexibility than typical databases or spreadsheets
4. Perform interactive examination of 3D models for material price estimating functions.
5. Dynamic reckoning
6. Count and quantify style knowledge quickly and simply.
7. a lot of economical manual takeoff
8. Supports the takeoff of JPG, TIF, PDF, and different “nonintelligent” image formats.
9. Share, query, and clarify
10. Generate quantities coupled to specific objects. Price and “round-trip” your comments.
11. quicker and a lot of perceptive amount reports
12. Produce summaries and elaborate amount measuring reports quickly and simply.

#### 2. PRIMAVERA

Primavera is employed for Execution. It is main phase in construction development.

Project Management in Primavera software system is that the coming up with, organizing, securing, and execution of the resources required to complete a project on time and among budget. The most purpose of project management is to realize all of the project goals whereas taking in to account the constraints of the project. Typical constraints related to a project area are unit time, scope, and budget. The secondary goal of project management is to contour the project management method guaranteeing that resources area unit allotted properly and every one the processes area unit efficient to create certain the project is completed on time and among the budget.

#### 3. BUILDERTREND

In this study Buildtrend is employed for management. Buildtrend may be a construction management system for home builders, remodelers, specialty contractors and general contractors.

It combines project programing, project management, monetary management, client management and repair management in an exceedingly single suite. Buildtrend + QBO vs. QuickBooks Premier Contractor Edition. Buildtrend with QuickBooks on-line integration provides you full monetary capabilities, as well as anytime/anywhere on-line access, absolutely loaded mobile apps, nice shopper communication options and construction management tools that basically change the method. Buildtrend is cloud-based construction project management computer code for homebuilders, remodelers and specialty contractors.

### 3.2 THE FIVE PHASES OF THE PROJECT MANAGEMENT LIFECYCLE

The phases related to project management comprise 5 classes including:

1. Initiation
2. Planning
3. Execution
4. Controlling
5. Closing

#### PHASE 1: INITIATION

The initiation part of the project management lifecycle involves the initial commence processes of a project. This part is wherever the project’s scope and purpose are outlined, justified, and enforced.

- A. Team members and managers are appointed
- B. The practicability of the project is studied
- C. Documentation is collected
- D. The project workplace is ready up

#### PHASE 2: PLANNING

The planning part is that the most important stage of the project management lifecycle. This part is wherever the project documents are finalized in Primavera P6 computer code and given to the project team members to be wont to complete the project. The look of a project falls involves the creation of 5 smaller plans including:

1. The Project Set Up
2. Resource Set Up

3. Monetary Set Up
4. Quality Set Up
5. Acceptance And Communications Set Up

In Primavera P6, the look part is started by making a piece breakdown structure, forming a price loaded schedule, distribution the resources to the project, and establishing a baseline.

### PHASE 3: EXECUTION

The project execution part is wherever the work is started and completed. Once the project plans are set, construction begins on the project and therefore the processes are compared against the baseline throughout the building of the project. The project team members use Primavera P6 computer code to

- Report add Progress
- Status the Schedule
- Compare Projected Start/ end Date Against Actual Start/Finish
- Compare Projected price Against Actual price
- Compare Projected Resource Usage Against Actual Resource Usage

### PHASE 4: MANAGEMENT

The management part of the project management life cycle is wherever the project team members investigate the results and judge whether or not the project is not off course or delayed. The project team members then use a project management tool, like Primavera P6 computer code, to research the schedule and assess the project. The team members can compare the baseline schedule against the particular schedule and build a recommendation to enhance the health of the project. If the project is delayed, the project team members can move into the Primavera computer code application, modify the project knowledge, so re-forecast the schedule. Then, the team members will move into Primavera P6 computer code and utilize the Claim digger practicality to stipulate the changes created between the schedule updates.

### PHASE 5: CLOSING

The closing method is that the final part of the project management life cycle. During this phase: 1. Project team members document lessons learned

2. Confirm if the project may be used as a baseline for different comes
3. Deliver the ultimate product to the stakeholder

## IV. CASE STUDY AND RESULT AND DISCUSSION

### 4.1 Tools and techniques

The construction comes became therefore huge and complicated that the applying of data technology has become inevitable. Firms started developing software's for project management like Primavera P6, P3, Suretrack, MS project, etc.

This study involves observation and dominant the project mistreatment Primavera P6. The progress at web site should be incorporated within the Primavera schedule and updated. These updates have to be completely monitored mistreatment Primavera. Tools and techniques concerned during this method are:

### 4.2 EARNED VALUE MANAGEMENT (EVM)

Earned price management may be a ordinarily used technique of performance measure. It integrates scope, cost, and schedule lives to assist the project management team assess and measure project performance and progress. This method needs the formation of AN integrated baseline against that performance is measured for the period of the project. This could be effectively tired Primavera. The project performance baseline is employed to live, monitor, and management overall price performance on the project.

### 4.3 WORK PERFORMANCE MEASUREMENTS

The calculated price variance, schedule variance, CPI, values for WBS parts, specially the work packages and management accounts, must be documented and communicated to stakeholders.

### Steps concerned in observance and management of this project area unit

1. Making a perfect schedule: to make a schedule for any project, beginning is to gather information offered for the project. Afterwards the subsequent steps are followed in primavera.
2. Enterprise project structure (eps): Produce the structure of the corporate with its branches that is death penalty the project. This is often called enterprise project structure (eps).
3. Structure breakdown structure (obs): when the eps, obs is made that could be a hierarchy that reflects the persons accountable forth come within the enterprise.
4. Making new projects: A project could be a set of activities and associated info that constitutes an inspiration for making a product or service. The project is made underneath the various divisions in eps and appointed the person answerable from obs thereto. The project is given planned begin and should end dates. The project is appointed a calendar which might be world, resource or project calendar.
5. Work breakdown structure (WbS): WbS could be a hierarchy of labor that has to be accomplished to complete a project. Every project has its own WbS hierarchy with prime level WbS component being capable that of every eps node or project. Every WbS component might contain a lot of elaborated WbS levels, activities, or both.
6. Defining activities: Activities area unit the elemental work components of a project and kind very cheap level of a WbS and, area unit the littlest subdivision of a project. Associate degree activity has the subsequent characteristics like activity id, name, begin and end dates, activity calendar, activity kind, activity codes, constraints, expenses, forerunner and successor relationships, resources, roles etc.
7. Relationship between activities: to from a network, the activities ought to be connected to every alternative, that is finished by assignment preceding and succeeding activities with important relationship to the activities.
  - Finish beginning (fs) relationship.
  - Finish finishing (ff) relationship.

- Start to start out (ss) relationship.
  - Start to end (sf) relationship.
8. Determinant activity duration: once designing the work, the period is entered within the original period field. The particular period will solely be entered for the activities, that area unit completed.
  9. Activity dates: the subsequent area unit the kinds of activity dates offered within the primavera; actual begin, actual end, planned begin, planned end.
  10. Activity price: the activity cost is that the add of all the price incurred to complete the activity.
  11. Making baselines: an easy baseline arrange could be a complete copy of the first schedule that provides a target against that a project's performance is half-tracked.
  12. Change schedule:
    - If the project is progressing specifically as planned, then solely required to estimate progress.
    - If the project isn't progressing as planned several activities area unit beginning out-of-sequence, actual resource use is olympian planned use, so update ought to be in hot water activities and resources on an individual basis.
  13. Most comes contain some activities that progress as planned and a few that don't. During this case, the most effective technique is to mix the 2 change ways.
  14. Attained worth: attained value could be a technique for mensuration project performance per each project price and schedule. The technique compares the budgeted price of the work to the particular price.
  15. Claim digger: the claim digger could be a schedule analysis tool that allows a corporation to get a report that compares elite information fields during a revised project and a corresponding baseline.
  16. Project thresholds: project thresholds carries with it parameters appointed to WbS elements; they're accustomed monitor comes and generate problems.
  17. Project problems: project issues area unit the issues inside a schedule that has to be addressed before the project is completed. They will either be created by thresholds or manually.

#### 4.4 PRELIMINARY STEPS TO BE DONE IN UPDATING

Choose project. Maintain baseline. Then add and save a duplicate of current project as a brand new baseline B1. Then select Project baseline as B1 and assign primary baseline as B1. Daily updates to be made.

#### 4.5 SCHEDULE ANALYSIS AND PREDICTION

Schedule variance (SV)

It determines whether or not a project is behind or prior the schedule. It's calculated by subtracting planned value from the earned value.

Schedule variance = earned value (EV) -Planned value (PV)

The Schedule Variance will be expressed as a proportion by dividing the schedule variance (SV) by the planned value (PV):

$SV\% = SV / PV$

Schedule performance index (SPI)

It indicates potency with that the project team is victimization its time. Schedule

performance index = earned worth / Planned worth

Time estimate at completion

We can generate a rough estimate of once project are going to be completed Estimate at complete = (BAC/SPI)/ (BAC/months)

BAC = Budget at completion

#### 4.6 COST ANALYSIS AND PREDICTION

Cost variance (CV)

It shows whether or not a project is beneath or over budget. Cost variance

(CV) = earned value (EV) - Actual price (AC)

This variety will be expressed as a proportion by dividing {the cost the value the price} variance (CV) by the earned value (EV).  
apoplexy =  $CV / ev$

Cost performance index (CPI)

It is one in every of the clearest indicators of the additive price potency of the project. Cost performance index (CPI) = earned value (EV) / Actual price (AC)

#### 4.7 IDEAL BASELINE FOR PROJECT

An ideal baseline B1 was created in Primavera for the case study. The work breakdown structure, activities and steps for activities square measure being mentioned here. The structure for the baseline is conferred from the WBS levels. In WBS grade is also once more sub divided. Activities return beneath the WBS.

DELAY ANALYSIS

The following reasons were determined throughout this work, which might be command accountable for delays;

1. Lack of data regarding advanced trailing strategies and software's.
2. Insufficiently versatile employees.
3. Lack of correct fund flow throughout the project progress
4. A significant portion of labor pool was from province and province. Regional festivals in these areas cause severe delays

in work progress.

5. Even though delay thanks to monsoon rain was already accounted within the baseline schedule, sudden extension of monsoon caused any delay in project progress.
6. Sand inconvenience to legal restrictions.
7. Late delivery of resources.

#### 4.8 COMPARISON OF EXISTING APPROACH AND PROJECTED APPROACH

##### CASE STUDY 1

The G+9, Residential Building situated in Pune Maharashtra is considered for the study. The total built up area is 97700 square measure. Further details are given below:

Floor to floor height: 3.5 m

Height of pedestal: zero.50 m on top of Ground Level Depth of Foundation: one.50 m below Ground Level.

External Walls: 250 metric linear unit thick together with plaster

Internal Walls: one hundred fifty metric linear unit thick together with plaster Parapet Walls:

250 metric linear unit thick together with plaster

#### 4.9 Main steps concerned in building construction work except initial coming up with square measure are as follows:

1. Mobilization
2. Piling
3. Column & beam concreting
4. block & support concreting
5. Post concreting works
6. Masonry work
7. Plastering
8. Flooring, dadoing
9. External wall application
10. Finishing

#### 1. EARNED VALUE ANALYSIS

The attained price of the work has been calculated once together with the particular cost of every activity comprehensive of expenditures. The subsequent details were obtained from calculations victimisation knowledge obtained from Primavera P6

TABLE NO 1. RESULTS OBTAINED FROM PEC APPROACH.

Project Budget (BAC)	Rs 6,07,81,495
Planned Value (PV)	Rs 4,79,17,756
Earned Value (EV)	Rs 4,26,24,087
Actual Cost (AC)	Rs 4,05,63,038
Schedule Variance (SV) SV=EV-PV	Rs 52,93,669
SV%=SV/PV	-11.05%
Schedule performance Index (SPI) SPI=EV/PV	0.89
Total Duration	21 Months
Estimate at Complete	23.6 Months
Cost Variance (CV) CV=EV-AC	20,61,048
CV%=CV/EV	4.84
Cost Performance Index (CPI) CPI=EV/AC	1.05
Estimate to Complete	Rs 1.82 Crore

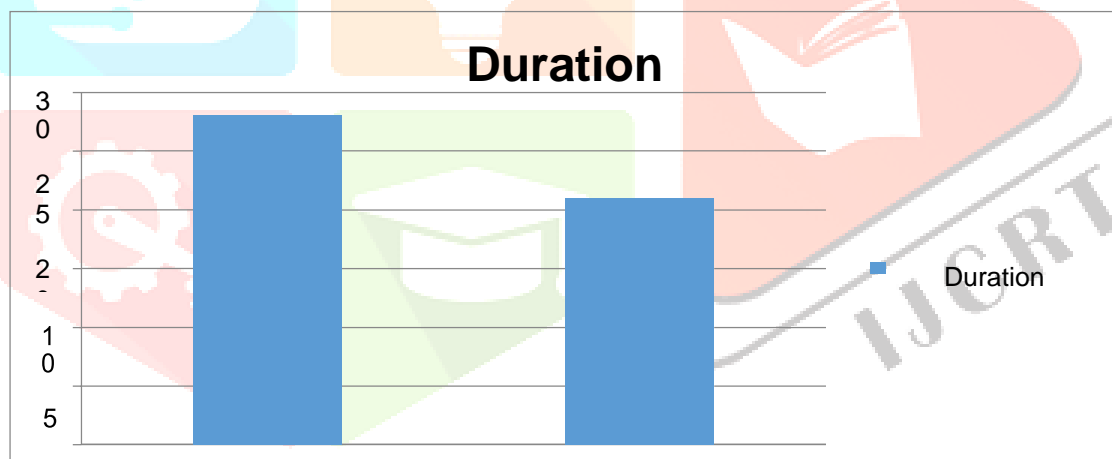
**Table No 2. Results Obtained From Traditional Approach**

Project Budget (BAC)	Rs 6,07,81,495
Planned Value (PV)	Rs 3,85,17,812
Earned Value (EV)	Rs 5,28,36,954
Actual Cost (AC)	Rs 4,05,63,038
Schedule Variance (SV) SV=EV-PV	Rs 14,31,91,142
SV%=SV/PV	-3.7
Schedule performance Index (SPI) SPI=EV/PV	1.3
Total Duration	28 Months
Estimate at Complete	23.6 Months
Cost Variance (CV) CV=EV-AC	12273916
CV%=CV/EV	0.23
Cost Performance Index (CPI) CPI=EV/AC	1.30
Estimate to Complete	Rs 2.52 Crore

Here we have a tendency to compare typical approach and primavera approach project budget is same in each situation i.e Rs 6,07,81,495. Planned worth in Primavera approach is Rs four,79,17,756 and in typical approach is Rs three,85,17,812. once calculation of boost it'll clearly defines that it denotes zero.89 in Primavera approach and one.3 in typical approach thus here we have a tendency to conclude that total period needed less time in Primavera approach and longer needed in typical approach alongside estimate price additionally.

**TABLE NO 3: TOTAL DURATION CONVENTIONAL VS. PEC APPROACH.**

Sr. No	Total Duration	Duration (Months)
1	Conventional Approach	28
2	Primavera Approach	21

**Figure No7: Total Duration Conventional Vs. PEC Approach.****TABLE NO 4: TOTAL ESTIMATE COST CONVENTIONAL VS. PEC APPROACH.**

Sr. No	Total Duration	Cost (Cr.)
1	Conventional Approach	2.52
2	Primavera Approach	1.82

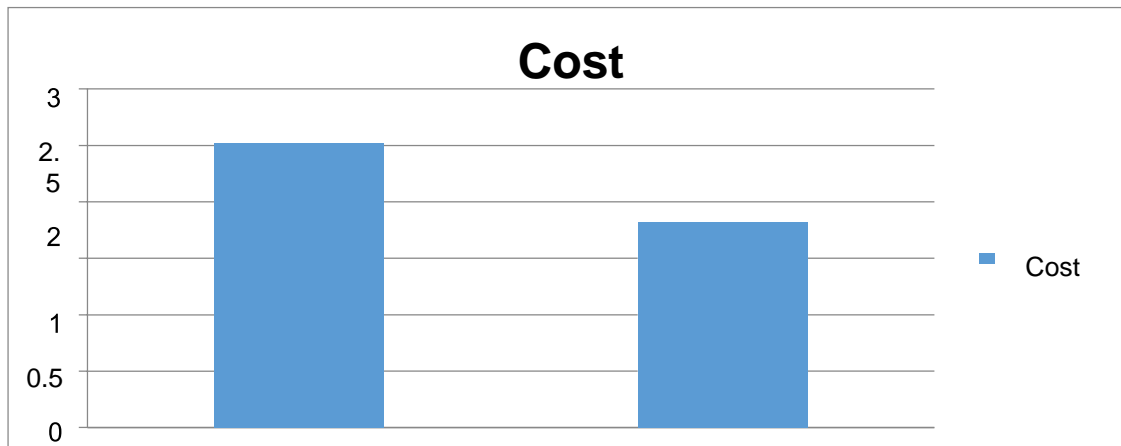


Figure No 8: Total Estimate cost Conventional vs. PEC Approach.

#### 4.10 S CURVE

It is graphical illustration of economic income of a project. It's derived from activity usage profile, associated it shows an "S" like form, blandish at the start and finish and vessel within the middle. This shows that prices concerned within the project is low within the starting additionally as within the finish, whereas it will increase at a speedy rate once the project is in its middle stage.

#### V. CONCLUSION

There are several strategies of skyrocketing productivity and profitableness in housing industry. There's huge study on the strategies that improve the profitableness that consists of fabric pursuit, healthy and safe operating condition and effective management systems. It's seen that some strategies are a lot of economical within the context of skyrocketing productivity. During this project we tend to compare case study with qualitative (PEC APPROACH) and ancient approach for G+7/G+6/G+9 residential building set at Ambegaon, Wagholi Pune. There's a requirement for exploring a lot of economical methods for rising the productivity additionally as profitableness of the little and medium construction corporations. It's been noted that increasing the profitableness by such higher than strategies have reduced value and time however haven't produce an efficient baseline within the field of housing industry. It'll additionally helpful for little and medium construction corporations in India.

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