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Time and Cost Control using Primavera P6 in Construction of Buildings

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***Abstract*:- Every Project is new on its own and to manage the project is the need of the project to meet a greater efficiency of work, project management is the practice of initiating, planning, executing, controlling and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time. Although the construction industry has been evolving for centuries and researchers have been seeking innovative solutions for decades, diverse challenges still exist for making the construction process faster, safer, cheaper and more accurate.**

The Study deals on an ongoing construction project of a Residential Building (G+2) and collect all the data related to that project from the concern agencies and track the processes of work deeply, with the use of a software named Prima Vera p6 which is a tool to plan a project and to track the progress of work time to time. We work on it and got to know many facts which are faced by the companies in there day to day working process. As I already mentioned that every project is new but we can learn from our mistakes to avoid those mistakes in future works. A Comparison of actual and original time and cost is performed in this study using project management software Primavera p6. Despite well-established planning and policies of project monitoring the process itself may not be efficiently accomplished.

I. INTRODUCTION

In Today's world to meet the increase in demands and changing market, the challenge every company is facing to reduce the construction cost by using effective technology, so that they can earn more and more profit by providing satisfactory services to the client. There are many such companies which are still working on traditional methods of management like using excel sheets and on paper work but in this study we provide the solution of effective use of technology like software's which are used to do effective scheduling and material procurement schedule and now a days it also include the stages of work with time and cost consumed in each phase of work. There are number of software's like Primavera, MS Project, SCORO, PROOFHUB, ASANA, BASECAMP etc. As we study that almost every second project is delayed by some time, by using these software's we can judge the delays while execution and can try to overcome that delay by reducing the time consumed in successor activities, if you will reduce time consumed in successor activities you can save your time and can achieve your final completion date as planned. Moreover, your indirect costs consumed in execution will also we reduced.

To achieve high financial performance, you need to adopt a new business models based on advanced technologies which will provide you a good level of productivity. To make decisions proactive you need to stretch far beyond the physical borders of the company. Primavera is a product which provides you a high level of extensibility and a great adequacy capacity of work, of any company of any field because Primavera is a platform which provides scheduling and management to a variety of sectors, company with different portfolio can also work on it.

II. OBJECTIVES OF STUDY

A. To suggest the importance and purpose of monitoring the construction work.
B. Surveying the techniques or tools, for the evaluation of the management of construction projects (M.S. Project, Primavera P6 Etc.)
C. To suggest guidelines to contractors for updating the project.
D. To determine the activities which are critical and causes major delays in the project, initially from the point of view of the client and also generally from a broader perspective.
E. To make a watch on the existing planning, techniques and tools in achieving goals to complete a project on time and within budgeted value.
F. To determine the level of effectiveness or otherwise of existing cost monitoring and control methods employed by contractors.
G. Assessing the suitability of contractor's approaches to project organization for cost monitoring and control.
H. To propose a specification, a structure and suitable components for a general construction management evaluation system.

III. METHODOLOGY

After identifying the use of IT in civil engineering from literature review and setting the objectives considering two software's **MS Project** and **PRIMAVERA** the following methodology has carefully design to achieve these objectives.

1. Collection of Literature- I have search number of papers which are relevant to my topic and studied them and pick the point which are actually related to my research and put it in my study.

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2. Selection of Project- It is important to select a project which must be started a finishes within my research time frame so that I can fully analyses the activities and can provide any recommendation which is needed, selected an on-going project at Golf Link, New Delhi .

3. Collection of Data- Data collection for the project which i have chosen is a very tough task because they don't wants there project to be researched but having links with project staff I managed to collect the related data.

4. Planning using Prima Vera P6- after Collecting data of different sources now make a planning schedule which they have planned, Budgeted cost.

5. Monitoring of planning- Now, monitor the activities time to time and enter the value of executed quantities because this is an item rate contract so, if the quantities of any work will increase may increase the actual cost of an activity.

6. Observation of complete project- By observing the project provides recommendations to avoid the similar problems in future.

STEPS INVOLVED IN MONITORING AND CONTROLS OF PROJECT ARE:

Creating an ideal schedule - To create a schedule for any project, first step is to collect data available of the project. Following steps can be followed in Primavera subsequently.

1. Enterprise project structure (EPS) – Enterprise Structure of the company with its branches, which executes the particular project is known as Enterprise project structure (EPS).
2. Organizational breakdown structure (OBS) – Organizational Structure is created just after the enterprise structure which is a hierarchy that reflects the persons responsible for the projects in the enterprise.
3. creating new projects – Every project is new in it and is a set of activities and associated information that constitutes a plan for creating a product or service. The project is created under the particular divisions in EPS and assigned the person in charge from Organization Breakdown Structure to it. The project must have a planned start and finish dates. The calendar should be chosen while project is assigned which can be global, resource or project calendar.
4. Work breakdown structure (WBS) - WBS is a hierarchy of work that must be accomplished to complete a project. Each project has its own WBS hierarchy with top level WBS element being equal to that of each EPS node or project. Each WBS element may contain more detailed WBS levels, activities, or both.
5. Defining activities - Activities are the fundamental work elements of a project and form the lowest level of a WBS and, are the smallest subdivision of a project. An activity has the following characteristics like activity ID, name, start and finish dates, activity calendar, activity type, activity codes, constraints, expenses, predecessor and successor relationships, resources, roles etc.
6. Relationship between activities - To from a network, the activities should be connected to each other, which is done by assigning preceding and succeeding activities with significant relationship to the activities.
   - Finish to start (FS) relationship- Finish to start relationship means that when last activity will finish the next activity will start, it can also be assumed that without ending the previous activity next activity can't be started.
   - Finish to Finish (FF) relationship- Finish to finish relationship means that two successor activity cannot finish until a predecessor activity has finished.
   - Start to start (SS) relationship- Start to start is a logical relationship in which a successor activity cannot start until predecessor activity has started.
   - Start to finish (SF) relationship-Start to finish is a logical relationship in which a successor activity cannot finish until a predecessor activity has started.
7. Determining activity duration - When planning the work, the duration is entered in the original duration field. The actual duration can only be entered for the activities, which are completed.
8. Activity dates - The following are the types of activity dates available in the primavera actual start, actual finish, planned start, and planned finish.
9. Activity cost - The activity cost is the sum of all the cost incurred to complete the activity. It may be consist of Labor cost + Material cost = Total Cost.
10. creating baselines - A simple baseline plan is a complete copy of the original schedule which provides a target against which a project's performance is tracked.
11. Updating schedule
    - If the project is progressing exactly as planned, then only needed to estimate progress.
    - If the project is not progressing as planned many activities are starting out-of-sequence, actual resource use is exceeding planned use, and then update should be done for activities and resources individually.
    - Most projects contain some activities that progress as planned and some which do not. In this case, the best method is to combine the two updating methods.
12. Tracking - Tracking window is used to monitoring a process of a project using different types of layouts such as labor costs, project cost, resource forecasting, resource allocation unit wise and cost wise.
13. Earned value - Earned value is a technique for measuring project performance according to both project cost and schedule. The technique compares the budgeted cost of the work to the actual cost.
14. Project issues - Project issues are the problems which a site engineer or a site in charge faces while executing the work of the project. Problems can be resolved by paying attention on time and finding the solution to it.

IV. FACTORS THAT AFFECT COST AND TIME IN CONSTRUCTION PROJECT

- *FACTORS*

The sum of money consumed in two identical Infrastructure projects will never be same no matter how similar they are. In spite of the technical factors, the huge range of economic and

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desires of clients indifferent will itself lead to variations. Nevertheless, the project costs are based on the actual material cost, equipment's used in construction cost, labor cost and most important the cost of the land in the region where the project is being carried out. The time of the construction may vary as per the requirement of client and how specifically the concept of client is clear to his vision. These costs & time will vary depending on the factors discussed below:

- **The Project Specification-** Specification of a project defines the design and physical condition of a project. For residential buildings, the required no. of rooms and expected occupancy rate will depend on specification of total rooms and floor plane size, room height, internal and external design, floor loadings, heating and lighting requirements. The more detailed the specification and the larger the project, the more expensive and completion. For example- The design and specification of a hospital, commercial complex, institutional, hospitality buildings are completely different from each other.
- **Location of the Building Project-** The project can also affected by geographical realities and site location. Such as if the project is running in a location the sand dust and the coarse aggregates are easily available and cost consumed in transporting these raw materials will be reduced. In geographical terms, land costs, building material costs, and design standards vary widely place to place and location to location because of the delay in materials supplies and the general market conditions if the location of a project is far from the local market and the reach to site is difficult then it will be costly in terms of transporting the material and so the manpower.
- **Repairing or New Buildings -** Generally, constructing a new infrastructure is more expensive than the repairing of existing buildings. But in some cases it is observed that the repairing of a infrastructure will cost more than the new infrastructure. This is initial so because the cost of the land unrations cost, service provision costs, etc. are not included when repairing and modifying existing structures but if the infrastructure will be damaged so badly than in that case it is advised to make it new in spite of doing repairing work.
- **Project Timescale-** Generally, the prolonged a project duration greater will be project cost. Project timescales are dependent on project specifications on its type. The bigger the project, the longer it takes to complete. But if the monitoring of a site will be done then it may finish early. In every project the one activity is dependent on other activity in most of the cases and because of delay in one the other one will be affected. The duration of a project will also impact on the financials of a project.
- **Characteristics of Site -** A site can be affected by soil profile and ground water level and its terrains conditions can also affects the Original cost and estimated time. The amount of excavation and foundation activities required is particularly affected by poor ground conditions. Where there is uncertainty about ground conditions, accurate project cost estimates cannot be achieved unless a soil survey is conducted.
- **Inflation of project costs-** Inflation of materials, equipment's and labor costs may vary geographically within the country and contracts between sub-contractors and suppliers may involve different inflation protection terms as agreed with the client. Due to inflation price of commodity, interest rate increases as a result over budgeting takes place.
- **Fluctuation in price of raw materials-** It is difficult to accurately estimate the price of material in developing countries where change in price may occur.
- **Construction cost under-** estimation Some time to get project approval from construction parties to acquire the contract under estimated cost instead of actual cost when the construction project proceeds they face financial crises due to wrong estimation .it is a negative practice that affect the project by cost overrun.
- **Change in foreign exchange rates-** The change in foreign exchange rate is important if materials or other elements of the construction project are being purchased from foreign countries. If the foreign exchange rate increases beyond the expected level, then the cost of the project may increase and that automatically leads to cost overrun.

4.1. Delays

As observed from the analysis above, one of the most common effects of cost overruns was delay. Delays in project completion can be attributed to factors such as:

1) Delay in payments due to interim documents

In this project, most contractors face difficulties to receive payment of completed work. The complex and long bureaucratic processes involved in checking and re-checking of all documents for completed projects by the various departments involved, to avoid any financial loss to the company.it tends to have a negative impact on the contractor's cash flow. It leads the contractor has no further option to leave the project and move on. This results a negative effect on the completion time of the project.

2) Variation Orders

Variation occurs mostly during the construction phase of the project. In this project variation in orders take time form client officials. It affects the construction programme and duration causing delay, rework, work extension and construction work speed.

3) Cash Flow

Fund is most vital need for completion of project and starting a new project. If the cash flow is improper it causes delays ultimately affects contractors cash flow there is high chance the project will get terminate. Improper cash flow affects the whole project and its stake holders so is the case in this project many a times client made a payment to the main contractor but the main contractor does not pay any money to their Sub contractor which are playing the major role.

4.2. Additional Costs

1) Additional Works

Additional works occur due to change in design during the construction phase. The additional cost will be required and it will be need to complete a particular project. This requires additional financial resources and additional work in between the project also make changes in planning.

2) Fluctuations Indian construction projects

Fluctuations are the result of increases in prices of materials as well labor costs and services due to high inflation rates. Fluctuations are very common throughout its entire phase. Fluctuation also comes by innovation of new taxes like GST.

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India is a developing country not a developed country like the United States Dollar, British Pound, etc., prices of materials will vary significantly to keep up with the exchange rate. Tenders quoted in India are likely to attract fluctuations

3) Inaccurate Estimates / Provisional Sums

Inaccurate estimating of a project cost can be very costly to the client. When proper enough studies are not conducted and all items of work not proper priced in the Bills of Quantities (BOQ) before works commences, the actual costs of these items of work are determined during construction. These costs which are usually rather higher than the provisional estimates allowed in the BOQ are added to the tender price thus high cost overruns.

4) Adversarial Relationship among Parties

Cost overruns could result in bad relationships among the parties to the Contract. Cost overruns could lead to a significant fall down in building activities, bad reputation and inability to secure project finance easily in future. Other effects of costs overruns worth mentioning are:

i. Workmanship quality is poor.
ii. Contractor affected by the poor cash flow of the client.
iii. Distribution of resources in fair and equitable manner.

- As in this study contract is an item rate contract and the contract is given to a Contractor on the basis of item rate with its quantities and the quantities of different items are identified the architectural team.
- They have planned a schedule for the work completion of the project using layman man technique (MS Excel).
- When i opt this topic for my study I decided to use Primavera P 6 for this project and I wanted to know how the layman technique and this modern technique saves the time and cost of the project.
- I made a file on the basis of their original planning and on the same time I followed up with the contractor who is working on the ground and entered the actual data (Quantities and total actual duration).
- This software also indicates us the original baseline of our project and by how much time and cost we are lacking or leading.
- We can try to minimize the actual duration of the upcoming activity if we are lagging behind in the past activity which save our time and so the cost because the time saving is directly proportional to the cost.
- As this is the item rate contractor so the contractor has to make sure that he will save more and more time to minimize his indirect expenses.
- The main of any Contractor must be to delivery their project on or before the Scheduled time duration, this makes Satisfactory client list and a satisfied client will recommend you to his society and friends.
- Now, what happens is that the original budget of contractor is Rs. 2,97,91,055/- and on this considering his 15% profit he will save Rs. 38,85,789/- but when this project got delayed by 40 days his indirect expenses increased and he loses his Rs. 5,60,000/- and as mentioned in contractor that delay will be penalized to the contractor by 5 lacks for 1 month and 7.5 lacks for 2 month, So total lose to contractor will be Rs. 7,93,333/- which is around 25.5%.
- As they do not have any planning tool which can track their work and because of unavailability of proper tool, they delayed their project by around 40 Days. If they use this planning and scheduling tool or any other tools they can save this time easily and their deliverables will be appreciated by client who will add in their achievement.

V. RESULT AND DISCUSSION

Based on the chosen project, this section analyses the main reasons for cost overruns and time overruns and they have many factors. The project we are studying is delayed from its scheduled completion time because of bad planning and short of finances. Based on the question asked to the project managers, sub-contractors, site engineer's results were taken. The data about this case is collected from the architecture firm and site staff, so it is important to make sure that they knew the definitions of the research.

The answers given by the project managers, sub-contractors, site engineers and representatives of clients from the discussion are analyzed. Some information about the company has been given from the interviewees and the information given has been verified through Internet research. One file on project management software is made on ongoing construction and the daily updates are entered in that and compared with the pre-planned schedule. Four interviewees have acknowledged to have semi-organized meeting. Along these lines, the whole research configuration of this thesis was focused around the four meetings which were conveyed by the two task administrator of an organization and the review after effects of members. Each of the undertaking administrators was talked with around two separate activities unified with great execution and an alternate with poor execution.

VI. CONCLUSION

- To reduce cost of the project we must ensure that the project must complete on time.
- To make project completion on time we must assure proper planning.
- For proper planning we must use a good tools and techniques for scheduling and tracking.
- As in the project mentioned above the contractor faces a loss of around 25.5% Which he can save if he will use a proper planning and scheduling tools and do proper tracking of all the activities.
- Contractor must ensure a on time completion record to get maximum number of project in the market.
- Contractor of project mentioned above can save 40 days, by just make a use of simple planning tool.
- Effective planning in bigger project is mandatory as we can see that in a project of cost just Rs.3 Cr. Contractor losses 8 Lacks and if this amount will increase the amount of loss will also we increased.
- Contractor must ensure the teams for completion of any particular activity will be available on time when it is needed.
- Never pick a sub-contractor which is either too less or too high than the actual completion cost.

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