EFFECTIVE PLANNING SYSTEM FOR CONSTRUCTION USING PRIMAVERA-(P3)

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ABSTRACT

We all are aware of the planning system play a vital role in a growth of a company. In any construction company the successful completion of its project and its growth in the industry depends upon the effective planning system. The work presented in this paper is the part of large initiative to meet major challenge faced by Construction Company.

A survey of construction practitioners was conducted to rank and determine the degree of influence of various factors on construction productivity. A field study gathered information for the refinement of the primary productivity of works.

The major significant problems affecting the productivity were identified and factors are analyzing to improve productivity and make the project to be successful.

The project management techniques of planning and scheduling are used to complete the project within the stipulated time, scope, quality and cost. This study dwells on the importance of construction schedules in achieving the aim of producing good quality construction work within the specified duration. These techniques can be useful to all types of construction project. In this project primavera project planner (P3) a powerful software tool is used for effective planning and scheduling for high-rise building.

Keywords: Construction Schedules, Effective Planning system, Labour productivity, Project management techniques.

1. INTRODUCTION

1.1 OBJECTIVE:

Construction projects are time bound and all project activities are directed towards the achievement of project objectives with respect to time, scope and quality. In a complex project where large number of activities is performed at different places by different agencies and sub organizations, with each having its own scheduled targets, a small delay in the critical activity can affect many Schedules.

Delays can alter the planned level of resources and their mobilization. Time overrun increases overheads, reduce planned revenue from sales and create fund inflow problems. Delays in contracted projects can result in penalties and adversely affect the reputation of the company. Project planning and scheduling aims at timely execution of work according to the project planned schedule and can apply corrective measures in case of any time deviations. In a broader sense, time control implies the control of the entire planning system, as time is directly or in-directly related with all project activities and project functions.

Construction productivity has been steadily on the decline over the last decade and construction labor efficiency has often been citied as poor. Activity sampling surveys in the US have found productive work to be as low as 32-46.5%. A pilot survey conducted on construction projects, has shown productive work to be between 33 and 56%. Since labor costs account for somewhere between 25 and 40% of the total project cost, reduction of these costs presents great potential as a source of increased productivity.

Construction productivity is influenced by many factors other than labor, including material, equipment, tools, construction method and management skills. However, these resources are inanimate, and meaningless if not transformed into productive tools by the human element. The quality of human performance depends largely upon motivation.

Today, very little has been done to improve the motivation of operatives within the construction industry. Companies undertaking large development projects all over the country occasionally initiate incentive schemes and other fringe benefits to motivate employees. However, very few companies have management policies for improving productivity.

The present economic situation (with the country having low productivity and a high inflation rate) has made productivity improvement imperative to the construction industry. In order to lower a country's inflation and construction costs simultaneously, recognition and sub-sequent rectification of factors affecting workforce motivation are essential.

1.2 AIM OF THIS STUDY:

The fundamental aims of the research reported in this paper may be summarized as follows.

- Identification and ranking of factors affecting the constructions productivity.
- Analysing these factors by using Delphi method.
- Collect and compare the various schedules from various construction industries.
- Make a schedule for G+3 building using of primevara(3) software effectively.

FUNCTIONS OF PROJECT MANAGEMENT:

Management is summarized into five basic functions

1. Planning
2. Organizing
3. Monitoring
4. Leading
5. controlling

2. LITERATURE REVIEW

2.1 CONSTRUCTION PROJECT PLANNING:

Oberlender (2000) agrees with Smith that planning coordinates all works of the construction to reach a completed quality project. The author determines the basic benefit of project planning and scheduling as an effective tool of preventing some of the problems like delays in work, cost overrun or decline in productivity and principally puts in order the desired results of project planning and scheduling as indicated below:

- Finish the project on time.
- Continuous (uninterrupted) flow of work (no delays).
- Reduced amount of rework (least amount of changes).

- Minimize confusion and misunderstandings.
- Increased knowledge of status of project by everyone.
- Meaningful and timely reports to management.
- You run the project instead of the project running you.
- Knowledge of scheduled times of key parts of the project.
- Knowledge of distribution of costs of the project.

Smith (2002) emphasizes the importance of careful and continuous project planning in the success of a realization of a project; and also notes that the activities of designers, producers, suppliers, workers and contractors, and their resources must be coordinated and integrated with the objectives of contractor

Arıkan and Dikmen (2004) give the definition of "planning" as "Trying to anticipate what will happen and devising ways of achieving the set of objectives and targets"; and point out that in planning concept there are always objectives to be reached in future. The authors describe planning as "a process during which efforts and decisions are made to achieve the goals at the desired time in the desired way." They further line up the main objectives of a construction project as follows:

- To complete the construction within the specified time (duration)
- To complete it within the budget, (with a profit)
- To complete it in compliance with technical and administrative specifications.

Project planning has been also defined as "the process of selecting the one method and order of work to be used on a project from among all the various methods and sequences in which it could be done" (Callahan, Quackenbush, and Rowings 1992). The authors also note that this process supplies detailed information used for time estimation and schedule; besides a baseline for project control.

Mubarak (2005) states that project planning works for several functions such as:cost estimating, scheduling, project control, safety management, etc. According to Arıkan and Dikmen (2004) the main purpose of planning is to provide the primary duties of the manager, namely, direction and control. The second objective of planning is to organize all the relationships and information systems among the many parties involved in the construction project. The authors further describe the third function of planning as enabling project control and forecasting.

2.2 PROJECT SCHEDULING:

Arthur W T Leung and Dr.C M Tam(2003)states that objectives in scheduling the floor cycle are to ensure smooth flows of resources and to optimize the use of formwork and other materials. The floor area is usually divided into zones to allow the labor force and formwork materials moving between zones.

Mubarak (2005) indicates scheduling concentrates on the timing and sequence of operations in the project planning effort. Therefore, while project planning covers the issues of what is going to be done?, where?, how? and when?, the term of project scheduling covers only the issue of when?.

Trauner, Manginelli, Lowe, Nagata and Furniss(2009)agree with Mubarak and define project schedule as "a written or graphical representation of the Contractors plan for completing a construction project that emphasizes the elements of time and sequence".

Trauner, et al. (2009), the project schedule should display all the construction tasks from the beginning of the project through completion, the time periods for each tasks, and the sequence of these tasks in a logical order.

UchennaUgochiMoneke(2012) states that principal aim of scheduling in project management is to plan the sequence of work so that activities can be systematically arranged towards the end of completion of the project. A workable schedule should be the one which does not expect impossible things to happen on the resources employed.

2.3 CONSTRUCTION SCHEDULE DELAYS:

Mubarak (2005) describe delay as "an event or a condition that results in finishing the project later than stipulated in the contract."

Trauneret al (2009) describe delay as "to make something happen later than expected or to not act timely". It is usual for delays to occur on construction projects.

Kaliba, Muya, and Mumba (2009) which aimed to determine the causes and effects of cost escalation and schedule delays in road construction projects in Zambia. The authors compile the main causes of delays in road construction projects which are determined according to their survey, as in the following: delayed payments, financial processes and difficulties on the part of contractors and clients, contract modification, economic problems, materials procurement, changes in drawings, staffing problems, equipment unavailability, poor supervision, construction mistakes, poor coordination on site, changes in specifications and labour disputes and strikes.

2.4 CAUSES OF CONSTRUCTION DELAYS:

Odeh and Battaineh (2002) carried out a study to determine the most significant causes of construction delays with traditional type of contracts with regard to contractors and consultants. According to the results of the study, owner interference, inadequate contractor experience, financing and payments, labor productivity, slow decision making, improper planning, and subcontractors are among the top ten most significant causes of delays.

Frimpong, Oluwoye, and Crawford (2003) carried out a study to determine and assess the relative importance of causes of delays and cost overruns in Ghana groundwater construction projects. The research showed that monthly payment difficulties from agencies, poor contractor management, material procurement, poor technical performances, and escalation of material prices were the main causes in the study.

Ahmed, Azhar, Castillo, and Kappagantula(2003), There are two groups of causes for delays in construction projects: external and internal causes. Internal causes of delays cover the causes, which come from four parties involved in that project. These parties are the owner, designers, contractors, and consultants. Other delays, which do not come from these four parties, are based on external causes for example from the government, material suppliers, or weather.

Mubarak (2005) groups the causes of construction delays in six categories regardless of who is at fault; as listed below:

- Differing Site Conditions

- Design Errors or Omissions
- Changes in Owners Requirements
- Unusually Adverse Weather
- Miscellaneous Factors

Odabaşı (2009) investigated factors affecting construction durations and models for estimating construction durations. The author selected from the literature and listed the most significant ones under eleven headings as: cost, cash flow, productivity on site, material procurement, project related factors, technology and methodology of construction, experience, coordination, weather, construction site, and the degree of completeness of design project

2.5 TYPES OF CONSTRUCTION DELAYS:

Kartam (1999) classified project delays into three main groups in terms of their origin, timing and compensability

- Delays classified by their origin: Owner caused delays (OCD), contractor caused delays (CCD), third party caused delays (TPCD)
- Delays classified by their timing: These are concurrent delays (CD) and non-concurrent delays (NCD).

Delays classified by their compensability: These are excusable delays (ED) which are also classified in itself as excusable compensable delays (ECD) and excusable non-compensable delays (ENCD), and non-excusable delays (NED).

According to **Trauner et al . (2009),** there are four main groups of construction delays:

- Critical or noncritical
- Excusable or non-excusable
- Compensable or non-compensable
- Concurrent or non-concurrent

2.6 TOOLS TO QUANTIFY DELAY IMPACTS:

Schedule analysis is used in order to identify delays and to measure the net impacts of delays on a project. Basic tools which are used in the schedule analysis are known as bar chart schedules and critical path method schedules.

2.6.1 Bar Charts:

Callahan et al. (1992) defines bar charts as "a collection of activities listed in a Vertical column with time represented on a horizontal scale". Bar charts show duration, start and finish times of project activities in chronological order. Henry L. Gantt developed bar charts during World War I. This tool is widely preferred since it is simple, easy to prepare and has an easily understandable format.

2.6.2 Critical Path Method:

Wickwireet al. (2003) describe CPM as "a graphic representation of the planned sequence of activities that shows the interrelationships and interdependencies of the elements composing a project." At first, CPM was introduced as a planning tool; however, later additional function of CPM appeared as proving delay claims. This function is the result of the ability of CPM as showing the picture of the project and changes.

3. SCOPE AND OBJECTIVE

3.1 SCOPE OF THE PROJECT:

This project is to study the effective of planning system for high rise building.

- To study of the productivity of labours used for the project.
- To analyse the factors affecting the labour productivity.
- To analyse its effectiveness.

3.2 OBJECTIVE:

- Insisting minimum requirement of labours in each work.
- Selecting better choice in each company and arriving a new format to improve the productivity for further project.
- Attending higher productivity by using low labour utilization.
- Minimizing the cost and time by proper scheduling for the project.
- Strategic suggestion for planning the project.
- Strategic suggestion for organizing the project.
- Strategic suggestion for monitoring the project.
- Strategic suggestion for leading the project.

4.FACTORS AFFECTING CONSTRUCTION PRODUCTIVITY

4.1 PRODUCTIVITY:

The measure of the rate at which work is performed is called "productivity". It is a ratio of production output to what is required to produce it. The measure of productivity is defined as a total output per one unit of a total input.

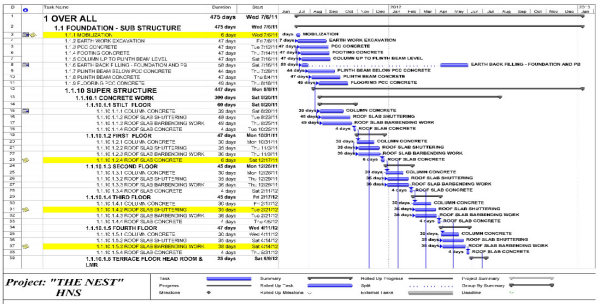
The productivity parameters which need to be controlled in construction projects are:

1. Labour productivity
2. Equipment productivity
3. Material productivity

4.2 FACTORS AFFECTING CONSTRUCTION PRODUCTIVITY:

The factors affecting the construction productivity can vary according to the location, cause, region, duration, and other factors.

1.Overtime, 2.Morale and Attitude, 3.Fatigue, 4.Stacking of Trades, 5.Joint Occupancy, 6.Beneficial Occupancy, 7.Concurrent Operation, 8.Absenteeism and Turnover, 9.Mobilize/Demobilize, 10.Errors and Omissions, 11.Start/Stop, 12.Reassignment of Manpower, 13.Late Crew Build-Up, 14.Crew size Inefficiency, 15.Site assess, 16.Logistics, 17.Security check, 18.Learning curve, 19.Ripple effect, 20.Confined space, 21.Hazardous work area, 22.Dilution of supervision, 23.Holidays, 24.Shorter Daylight 25.Weather and season changes, 26.Rain, 27.Shift work, 28.Working in operating area, 29.Overmanning, 30.Tools and equipment shortage, 31.Area practices, 32.Proximity of work, 33.Alternating,Staggered,Rotating work schedules.



4.3 Remarks:

In **schedule-1**

- **Activity 1.1.1** Mobilization is delayed 1 day due to **site access** problems. This problem cannot be eliminated but can be avoided by selecting alternate route for the site.
- **Activity 1.1.10.1.2.4** Roof slab concrete is delayed 2 days due to **Tools and Equipment shortage**. This problem can be eliminated by pre-planning the schedule of Tools and Equipment.
- **Activity 1.1.10.1.5.3** Roof slab bar bending work is delayed 2 days due to **climate change**. This problem can be eliminated by doing the works inside the roof slab.
- **Activity 1.1.10.2.3** First floor brick work is delayed 5 days due to **crew size inefficiency**. This problem can be eliminated by proper labour scheduling.
- **Activity 1.1.10.2.4** Second floor brick work is delayed 3 days due to **Late Crew set-up**. This problem is mainly because of not scheduling the labour properly.
- **Activity 1.1.10.1.4.2** Roof slab shuttering is delayed 1 day due to **Confined space**. This problem is mainly because of not proper scheduling of labour.
- **Activity 1.1.10.3.2** First floor plastering is delayed 2 days due to Reassignment of manpower. This problem is mainly because of not proper scheduling of labour.
- In the **schedule-2**
- **Activity 26** Basement Flooring (cc1:4:8) is delayed 1 day due to **Over- manning**. This problem can be eliminated by proper labour scheduling.
- **Activity 50** Casting of column above lintel is delayed 2 days due to **Logistics**. This problem can be eliminated by Proper material handling.
- **Activity 71** Casting of second floor slab is delayed 2 days due to **Dilution of supervision**. This problem can be eliminated by proper supervision.
- **Activity 86** Placing of steel for beam / slab / staircase II for TF roof is delayed 5 days due to **Rain**. This problem cannot be eliminated but can be solved by alternating the schedule.
- **Activity 105** Casting of Fourth floor roof is delayed 1 day due to **Area practices**. This problem can be eliminated by avoiding the extended coffee breaks

5. PRIMAVERA

5.1 INTRODUCTION TO PRIMAVERAPROJECT PLANNER:

- Primavera project planner is a product from primavera systems Inc, USA. P3 offers easy to use approach to project planning with an inherent interact that means project planning and control easy.
- P3 is a multi-user product that operates on popular Local Area Networks.
- It allows the user to share data with other network users and with anyone who manages projects using P3. With P3 the user can schedule and manage up to one lakh activities.

5.2 DEFINITION OF PRIMAVERA PROJECT PLANNER:

Primavera is a project management software package that is used for managing and controlling project related activities.

5.3 ADVANTAGE OF PRIMAVERA:

- Primavera software feature several tools that help contractors manage projects, regardless of the project size.
- The application can generate detailed report about the status of a project at any time.
- These reports include information about forecast cost, budgets, deliverables and previously established project goals.
- Additionally primavera contract manager helps to keep track of each phase of the project using complete project control.

5.4 FEATURES OF PRIMAVERA PROJECT PLANNER:

- P3 allows the user to select the information from the database, sort data in dozens of different ways, and condense details and present graphic presentation.
- Primavera uses as the record management system for handling project files.
- It helps to build a project network quickly and graphically.
- Offers various activity types so that the user can made different activity and resource interactions.
- As many as 10 types of restrictions (constraining) can be imposed on activities.
- The user can compare normal vs. overload staffing on the schedule in onscreen histogram curves.
- As the actual data is recorded, Primevara automatically changes estimate to complete.

6.RESOURE ANALYSIS AND ESTIMATION

6.1 ANALYSIS OF RESOURCES:

Table 1: Analysis of resources

S.No.	Particulars of items	Quantity	Per day
1.	Brick work in lime or cement mortar in foundation and plinth	1.25cum	(45cuft)per mason
2.	Brick work in lime or cement mortar in superstructure	1.00cum	(35cuft)per mason
3.	Brick work in mud mortar in foundation and plinth	1.50cum	(55cuft)per mason
4.	Brick work in mud mortar in superstructure	1.25cum	(45cuft)per mason
5.	Brick in cement or lime mortar in arches	0.55 cum	(20cuft)per mason
6.	Brick in cement or lime mortar in jack arches	0.55 cum	(20cuft)per mason
7.	Half brick wall in partition	5.00sqm	(50sqft)per mason
8.	Coursed rubble stone masonry in lime cement mortar	0.80cum	(30 cuft)per mason

	including dressing		
9.	Random rubble stone masonry in lime or cement mortar	1.00cu m	(35cuft)per mason
10.	Ashlars masonry in lime or cement mortar	0.40cu m	(15cuft)per mason
11.	Stone arch work	0.40cu m	(15cuft)per mason
12.	Lime concrete in foundation or floor	8.50cu m	(300cuft)per mason
13.	Lime concrete in roof terracing	6.00cu m	(200cuft)per mason
14.	Lime concrete 1:2;4	5.00cu m	(175cuft)per mason
15.	RB work	1.00cu m	(35cuft)per mason
16.	RCC work	3.00cu m	(125cuft)per mason
17.	12mm (1/2) plastering with cement or lime mortar	8.00sq m	(80sqft)per mason
18.	Pointing with cement or lime mortar	10.00sq m	(100sqft)per mason
19.	White washing or colour washing coats	70.00sq m	(700sqft)per white washer
20.	White washing or colourwashing coats	200.00sqm	(2000sqft) per white washer

7.EFFECTIVE PLANNING FOR MANPOWER PRODUCTIVITY IN VARIOUS ACTIVITIES

SIGNIFICANCE OF PRODUCTIVITY:

Benefits derived from higher productivity are as follows:

1. It helps to cut down cost per unit and thereby improve the profits.
2. Gains from productivity can be transferred to the consumers in from of lower priced products or better quality products.
3. These gains can also be shared with workers or employees by paying them at higher rate.
4. A more productive entrepreneur can have better chances to exploit export opportunities.
5. It would generate more employment opportunities.

8.SCHEDULING USING PRIMAVERA (P3)

8.1 GENERAL DETAILS:

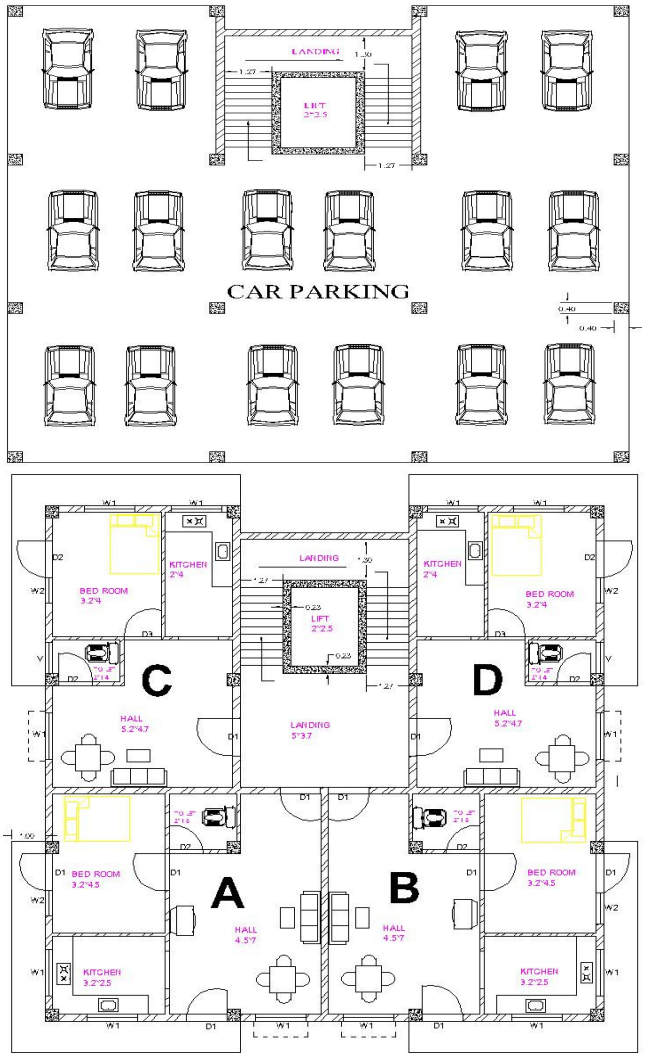
Type of Building :Residential Building
Type of Structure :Framed Structure
No of Storey :G+4
No of staircase :1
No of lifts :1
Type of staircase :Open quarter with landing
Column size :400x400 mm
Type of foundation :Isolated Square footing
Grade of concrete :M25
Grade of steel :Fe415
Location :Tiruvannamalai

Ground floor

Plinth Area :277.2 m^2
Carpet Area :263.21m^2

First floor

Plinth Area :321.6 m^2
Carpet Area :293.07m^2



8.2 SCHEDULING REPORT:

Primavera Scheduling and Leveling Calculations -- Scheduling Report Page: 1

This Primavera software is registered to skpit.
Start of schedule for project skpit.
Serial number...19126321
User name : K.Rajalakshmi

Open end listing -- Scheduling Report Page: 2

Activity A001 has no predecessors
Activity B041 has no successors
Activity B131 has no successors
Activity B201 has no successors
Activity B221 has no successors
Activity C041 has no successors
Activity C101 has no successors
Activity C131 has no successors

Activity C311 has no successors
Activity C341 has no successors
Activity D041 has no successors
Activity D131 has no successors
Activity D301 has no successors
Activity D331 has no successors
Activity E041 has no successors
Activity E131 has no successors
Activity E271 has no successors
Activity E301 has no successors
Activity E331 has no successors
Activity F041 has no successors
Activity F131 has no successors
Activity F331 has no successors
Activity H001 has no successors
Activity I001 has no successors
Activity I011 has no successors
Activity I021 has no successors
Activity I031 has no successors
Activity I041 has no successors
Activity I051 has no successors
Activity I061 has no successors
Activity K011 has no successors
Activity L231 has no successors

Scheduling Statistics for Project skpit:
Schedule calculation mode - Retained logic
Schedule calculation mode - Contiguous activities
Float calculation mode - Use finish dates
SS relationships - Use early start of predecessor
Schedule run on Sun march 15 21:02:27 2018
Run Number 62.
Number of activities..... 214
Number of activities in longest path.. 167
Started activities..... 0
Completed activities..... 0
Number of relationships..... 219
Percent complete..... 0.0
Data date..... 09APR18
Start date..... 09APR18
Imposed finish date.....
Latest calculated early finish..... 06JUN18

9. CONCLUSION

1. In many construction company are having a major asset as a labour the profit and the losses of the company is based upon that labour productivity.
2. The productivity of the labour may varies depending upon the individual and company regularities. The major of the problem may occur in the company regulation because of the labours may not be individual mindset to the management have to play and make the company to withstand in the industries.
3. In this thesis the factors affecting labours individual and company productivity were analyse by Delphi Method.
4. In the view of management the important parameters considered in the thesis are planning, motivation, monitoring, controlling, etc.., of labour and depends the lack of execution of the project future need as a effective planning for project.
5. In this project learning the primavera is a project management software package that is used for managing and controlling project related activities and later the primavera have been made as better format for the future project.

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