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Improving Productivity in Construction Management Using Primavera

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ABSTRACT

After Agriculture the Construction industry is the second largest and basic input for socio-economic development of our country, which has contributed an estimated amount of ☐ 928418 crores to the national GDP in 2018-19, a share of around 8.04% (Planning Commission, Government of India). Though construction projects in India facemany problems, delay in construction is still one of the major issues. A lot of research has been done to find and analyse productivity in Indian construction industry. Research on productivity in construction related activities were limited to large and medium sized projects.

The purpose of this study is to identify factors affecting productivity of a shopping centre construction project. This project includes literature reviews on productivity in construction industry. From the literature review he paper different method which are used for measurement of construction productivity, factors affecting and theories on improvement of construction productivity such as labour, Material & Equipment factor, and the project further reviews on the different innovations which are made for improvement in construction productivity shall be known. On reviews it is noted that there are various methods and strategies for improvement of construction productivity but they differ from site conditions and the factors which influence construction productivity. It is recommended to develop resources through an organized approach to overcome the disruptions on the performance of the construction projects. Eventually, the chosen key factors are anticipated to assist in completing construction projects using SPSS Software and then the productivity is improved by Primavera P6 software successfully.

KEYWORDS: Construction Project, Factors, SPSS, Productivity, Primavera P6.

1. INTRODUCTION

Construction industry is world's biggest and challenging industry. Human resource encompasses a vital role in increasing the productivity in construction industry. Proper and optimum use of human resources can help in productivity growth. The construction projects which are mostly labour based with basic use of hand tools and equipment's consists of labour costs about 30% to 50% of the total project cost. Indian construction industry being one in allfastest growing sector globally shares about 8% of total GDP and also provides employment to around 35 million peoples directly or indirectly.

Many researchers have shown that poor construction management practices ends up in poor performance, wastage of efforts in all four phases of the construction project. Researchers tried to beat up number of challenges by adding their efforts in construction project, however many problems are yet to be solved in terms of construction productivity. Identifying and analysing the critical factor that influence construction productivity will help develop the most effective method and strategy which help improve the construction productivity in upcoming time.

Construction project is alleged to be successful if it is completed within schedule duration and estimated cost. For that purpose productivity has to be efficient. Productivity forecasting plays a crucial role in strategic and operational planning. Quantitative forecasting is employed for decision making process for several complex situations.

2. OBJECTIVE

The main objectives of the study are to;
- Analyze and calculate the Relative Important of those factors affecting labour productivity.
- Study and discuss various factors affecting labour productivity in construction industry.
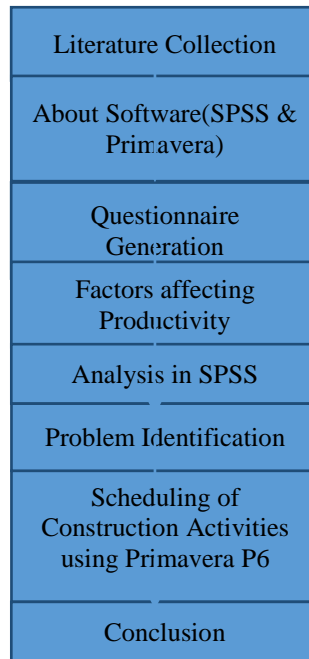- Arrive the scheduling of a project in by using primavera software.

3. METHODOLOGY

Literature Collection
About Software(SPSS & Primavera)
Questionnaire Generation
Factors affecting Productivity
Analysis in SPSS
Problem Identification
Scheduling of Construction Activities using Primavera P6
Conclusion

Figure 1: Methodology Flowchart

3.1   ABOUT SOFTWARE

3.1.1 SPSS

SPSS Statistics is a software package used for logical batched and non- batched statistical analysis. Long produced by SPSS Inc., it was acquired by IBM in 2009. The current versions (2015) are officially named IBM SPSS Statistics. Companion products in the same family are used for survey authoring and deployment (IBM SPSS Data Collection, now divested under UNICOM Intelligence), data mining (IBM SPSS Modeler), text analytics, and collaboration and deployment (batch and automated scoring services). SPSS is software for editing and analysing all sorts of data. These data may come from basically any source: scientific research, a customer database, Google Analytics or even the server log files of a website. SPSS can open all file formats that are commonly used for structured data such as Spreadsheets from MS Excel or Open Office; Plain text files (.txt or .csv); Relational (SQL) databases; Stata and SAS.

3.1.2 PRIMAVERA

Primavera P6 is a tool like no other when it comes whenever you think about planning and scheduling. Usually, it is hard to match what you have learned in a course with the REAL LIFE. Most of the courses out there don't do this - they give you knowledge and you might not know how to use it. *This course is different it is with a real Construction Case Study from scratch.*Primavera P6 allows you to organize and manage the project ahead visually. You will breakdown the project into activities and create activity list in the Primavera P6. It allows you to manage the project scope, resources and it is beautiful in illustrating the time claims. Always remember that planning and scheduling is a knowledge area that can be easily represented using an amazing tool such as Primavera P6. Construction projects are never easy. That's why this course has taken a construction case to carefully study it and make a schedule.

3.2   QUESTIONNARIE PREPARATION

The design of questionnaire was done based on the study of various literature reviews and is as follows;

Table 1: Questionnaire form involving factors influencing construction productivity

S. No	Factors	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	Does Leasing Is More Economical Compare to Owning of Construction Equipment?					
2	If the Renting of Construction Equipment More Economical Compare to Owning of Construction Equipment?					
3	Is There, Skilled operator Will Be Important for Machinery Operating					
4	Does the Regular Maintenance Reduce Equipment Loss?					
5	Does Equipment Affect by Irregular Maintenance?					
6	Is the Automated Monitoring System Better Than the Conventional Monitoring System?					
7	Does Organization Follow Any Maintenance Chart?					
8	Does the Regular Inspection Avoid Cost Overrun in Construction Industry?					
9	Will the Equipment Maintenance Affect by Improper Cashflow?					
10	Does the Work Affect by Improper Site Condition?					
11	Does the Labour Supervision Required for Proper Work Completion As Per Schedule?					
12	If the Skilled Labours Required for The Quick Work Completion?					
13	If the Training Is Important for Prevent the Work Delay in Construction Industry					
14	If the Facilities of The Labour Is Must in A Working Site					
15	Is the Labour Contractor Involved In Any Meeting					
16	Does the Motivation Class Required for the Labours					
17	Does Any Incentives Provided for The Labours					
18	Does the Project Manager Leadership Is Important for Successful Project Completion					
19	If the Weekend Payment Increase the Labour Productivity					
20	Is the Unclear Instruction Leads A Work Delay					

3.3 SPSS ANALYSIS

STEP 1: Defining Variables in a New Data Set

Variables are defined one at a time using the Define Variable dialog box. This box assigns data definition information to variables. To access the Define Variable dialog box, double-click on the top of a column where the word var appears or select Define Variable from the Data menu.

STEP 2: Entering Data in a New Data Set

Once all of the variables are defined, enter the data manually (assuming that the data is not already in an external file). The data is typed into the spreadsheet one cell at a time. Each cell represents an observation.When information is typed into a cell, it appears in the edit area at the top of the window. The information is entered into the cell when the active cell is changed. The mouse and the tab, enter, and cursor keys can be used to enter data.To indicate a cell that does not have a data value, a period is entered. A period represents the system-missing value.

STEP 3: Saving a New Data Set

Work performed on a data set only lasts during the current session. To retain the current data set, it must be saved to a file.
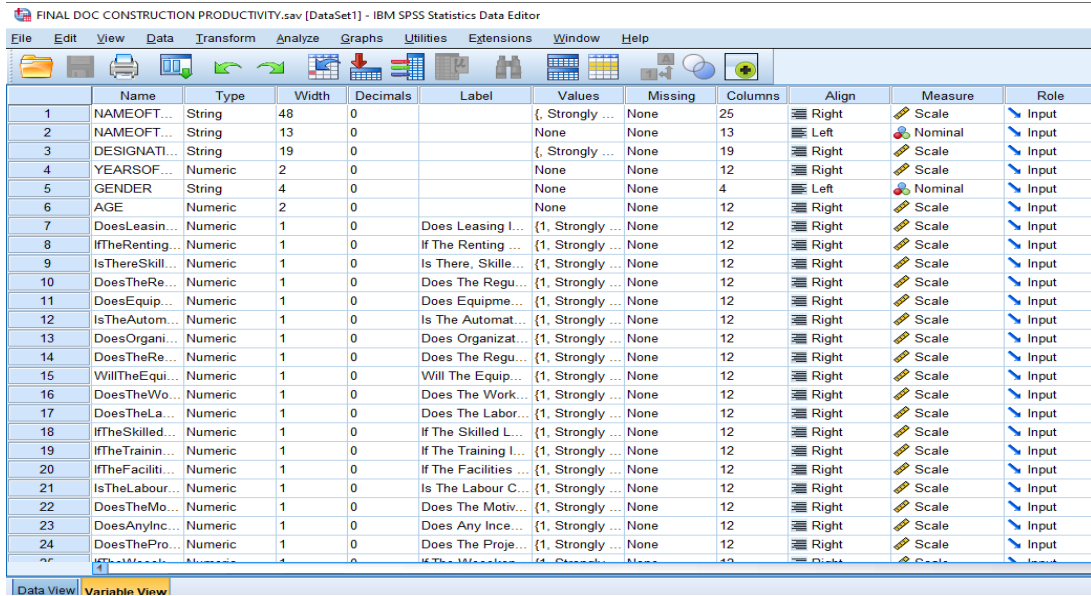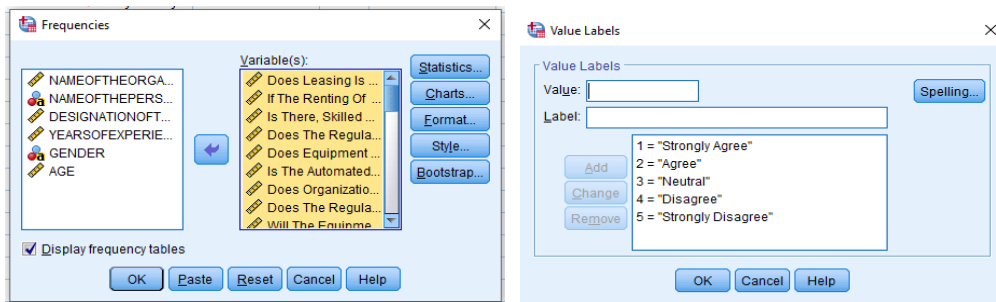
Figure 2: Data Entry in SPSS

Figure 3: Labeling in SPSSFigure 4: Input for frequency analysis in SPSS

3.4 RII (RELATIVE IMPORTANCE INDEX)

The relative index of inequality (RII) is a regression-based index which summarizes the magnitude of socio-economic status (SES) as a source of inequalities in health. RII is useful because it takes into account the size of the population and the relative disadvantage experienced by different groups. The disease outcome is regressed on the proportion of the population that has a higher position in the hierarchy.

It is used determine the relative importance of the various causes and effects of delays. The same method is going to adopted in this study within various groups (i.e. contractors, project engineers, owner and site supervisor). The four-point scale ranged from 1(strongly disagree) to 5 (strongly agree) is adopted and transformed to relative importance indices (RII) for each factor as follows:

$$RII = \Sigma W / (A*N)$$

Where, W is the weighting given to each factor by the respondents (ranging from 1 to 4), A is the highest weight (i.e. 5 in this case), and N is the total number of respondents. Higher the value of RII, more important was the cause of delays. Table 5.3 shows the ranking results of delay factors.

Table 2: Rating Scale

Category	Strongly Agree	agree	Average	disagree	Strongly disagree
Response rated	1	2	3	4	5

Table 3: Ranking of the construction productivity factors

S. No	Factors	RII	Rank
1	Does the Regular Inspection Avoid Cost Overrun in Construction Industry?	0.612	1
2	Does Organization Follow Any Maintenance Chart?	0.608	2
3	Does Any Incentives Provided for The Labours	0.600	3
4	Does the Misunderstanding Among Labour Is Reduce the Labour Productivity	0.600	3
5	Does the Motivation Class Required for The Labours	0.592	4
6	Does the Availability of Labour in Market and Competition Between Them Increase the Labour Productivity	0.588	5
7	If the Training Is Important for Prevent the Work Delay in Construction Industry	0.584	6
8	Does the Irregular Payment Cause A Labours Strike	0.580	7
9	Does the Absenteeism of The Labours Affect the Day Work Schedule	0.576	8
10	Is the Labour Low Wage Reduce the Work Flow in Construction Industry	0.572	9
11	Does the total budget of the project also decide the productivity in construction industry	0.568	10
12	Does the Project Manager Leadership Is Important for Successful Project Completion	0.568	10
13	Does the Labour Supervision Required for Proper Work Completion as Per Schedule?	0.568	10
14	If the Concrete Mixing Equipment Increasing Speed of Concrete Quantity?	0.560	11
15	If the Facilities of The Labour Is Must in A Working Site	0.560	11

3.5 RESULTS AND DISCUSSION

Table 4: Does the Regular Inspection Avoid Cost Overrun In Construction Industry?

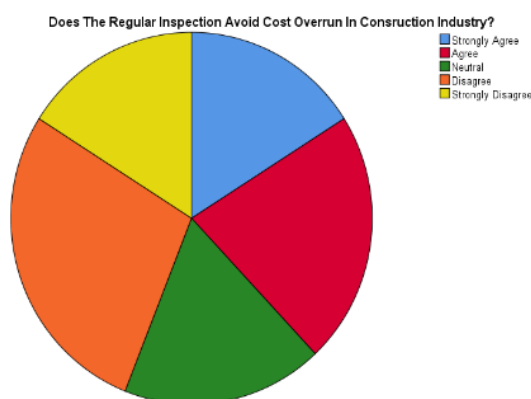|		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	8	16.0	16.0	16.0
	Agree	11	22.0	22.0	38.0
	Neutral	9	18.0	18.0	56.0
	Disagree	14	28.0	28.0	84.0
	Strongly Disagree	8	16.0	16.0	100.0
	Total	50	100.0	100.0	

Figure 5:Does the Regular Inspection Avoid Cost Overrun In Construction Industry?

Table 6: Does Organization Follow Any Maintenance Chart?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Agree	8	16.0	16.0	16.0
	Agree	11	22.0	22.0	38.0
	Neutral	12	24.0	24.0	62.0
	Disagree	9	18.0	18.0	80.0
	Strongly Disagree	10	20.0	20.0	100.0
	Total	50	100.0	100.0	
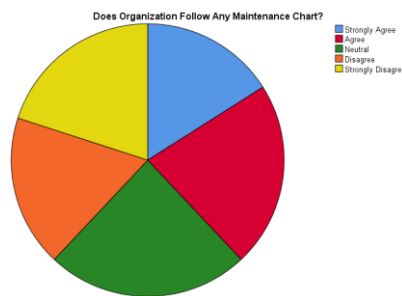
Figure 6:Does Organization Follow Any Maintenance Chart?

3.6 SCHEDULING IN PRIMAVERA

3.6.1 Creating EPS

The EPS is a hierarchy used to organize projects, and to associate Organizational level security with that project structure. When you create the enterprises project structure, you must identify an OBS element, or person responsible for each node and project within EPS.A default root node displays in the top left position in the hierarchy. All project listed below it are the part of same structure. You can also define multi root nodes to separate various component of you of your enterprises. For example, you might want to exclude inactive or what-if project from the main enterprises. To define root node, click the left arrow key to move an EPS element to top left position in the hierarchy, and then add the hierarchy of project below this node. Firstly, we had created the EPS of our project i.e. Enterprise Project Structure.
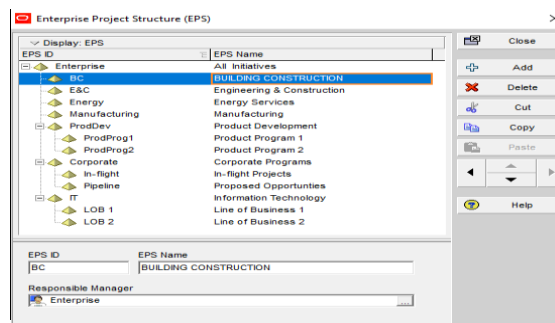

Figure 7: Creating EPS

3.6.2 Creating WBS

The work breakdown structure (WBS) is a hierarchical system that represents the construction project in increasing levels of detail to define, organize and display the project work in measurable and manageable components.One of the first steps in planning a project is to break down the project into its major deliverables i.e. major product or service components. This is known as the Work Breakdown Structure (WBS). After you have created the WBS, you can then create the activities required to achieve those deliverables.PRIMAVERA P6 encourages you to create a work breakdown structure (WBS) at the beginning of the project. This is known as a top down approach. Primavera P6 recognizes the importance of the project management team keeping their "eye on the ball" throughout the project life cycle. This means that you maintain a focus on the end product or service, which is the whole purpose of the project.
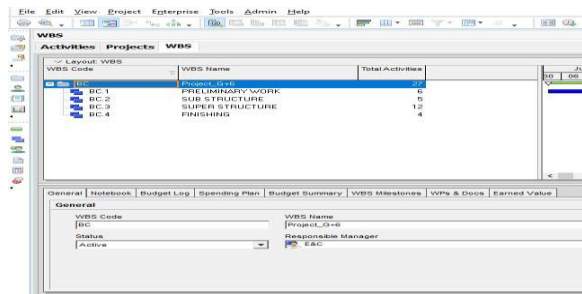
Figure 8: WBS

3.6.3 Creating Calendar and Activities

Before assign activities firstly we have to create a calendar for the project. You can create and assign calendars to each resource and each activity. This calendar defines the available work hours in each calendar day. You can also specify national holidays, your organization's holiday, project specific work or non-work days, and resource vacation days.

- Calendars are assigned to activities, not projects
- Calendars have 3 different time levels to work with
- Primavera P6 Calendars come in 2 flavors – Activity and Resource
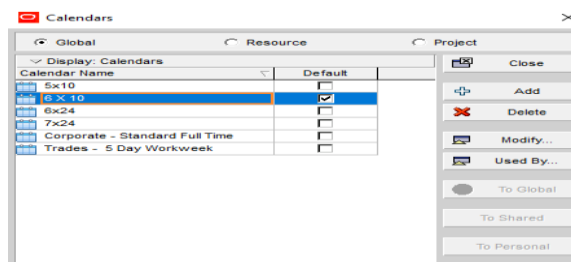- Changing an Activity's Calendar can sometimes mess up your Durations

Figure 9: Creating Calendar

3.6.4 Scheduling

Scheduling is the process of determining the sequential order of the planned activities, assigning realistic durations to each activity and determining the start and finish dates of each activity.The project schedule provides a graphical representation of predicted task, milestone, dependencies, resources requirement, task duration and deadlines. The project schedule should be detailed to show each WBS to be performed, the name of the person responsible to completing the task, the start and end date of each task, and the expected duration of the task.Like the development of each of the project plan components, developing a schedule is an iterative process. Milestone may suggest additional task, task may require additional resources, and task completion may be measured by additional milestone. For large, complex project, detailed sub-schedules may be required to show an adequate level of detail for each task.
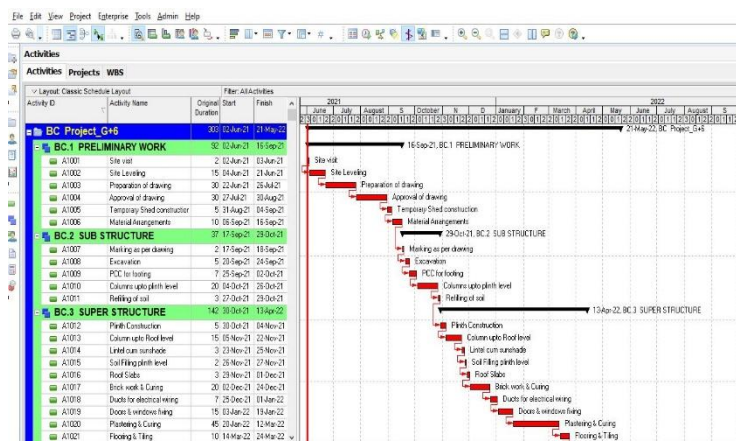

Figure 10: Activities

3.6.5 Relationship Types

Thus, if the start of one activity lags behind the start of another, or if one must lead the other by a period of time, these Construction scheduling is intended to give us an understanding of when activities are to start and finish so crews, materials, and equipment can be effectively managed to complete a project on time and on budget. Schedule logic indicates which activity or activities must be completed before another or others can start. Originally, Critical Path Method (CPM) schedules (Activity on Node (AON) and Activity on Arrow (AOA)) had only

Finish-to-Start (FS) relationships. Construction scheduling software manufacturers responded to the need for flexibility in activity relationships in a schedule by creating features permitting construction schedulers to create much more than simple

Finish-to-Start networks. Along with the typical Finish-to-Start relationship, other types of relationships (Start to- Start, Finish-to-Finish, and Start-to-Finish) are available to define the logic between work activities. In addition, these relationships may be customized to further define the relationship between the activities, known as lag or lead-time.

Before we begin the discussion of Best Practices, let's define some of the basic types of activity relationships we will discuss:

• Finish-to-Start (FS): A relationship between activities in which the start of a successor activity depends on the finish of its predecessor activity.

• Start-to-Start (SS) A relationship between activities in which the start of a successor activity depends on the start of its predecessor.

• Finish-to-Finish (FF): A relationship between activities in which the finish of a successor activity depends on the finish of its predecessor.

• Start-to-Finish (SF): A relationship between activities in which a successor activity cannot complete until its predecessor starts.
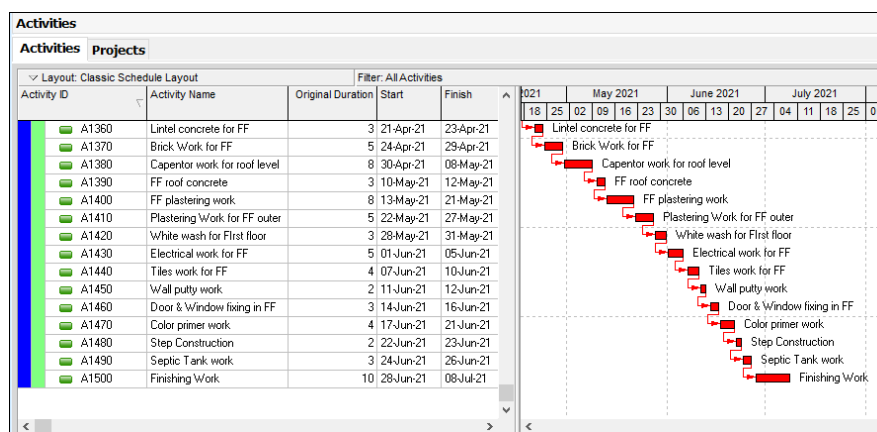

Figure 11: Assigning Relationship

4.   CONCLUSION

Factors affecting productivity in construction can be divided into two categories: human-related factors and management-related factors. These factors affect the morale and motivation of individuals. Quality of supervision, material management, site planning, constructability, and change management are the most significant management-related factors that influence productivity directly. The cost of the project must include the cost of equipment needed to build the project. The constructor must be able to determine, as accurately as possible, the duration of each piece of equipment required for each activity of the project. In our project focused on leading construction equipment planning and management problems in construction projects.

The result indicates the Regular Inspection Avoid Cost Overrun in Construction Industry, Organization Follow Any Maintenance Chart, Any Incentives Provided for The Labours, the Misunderstanding Among Labour Is Reduce the Labour Productivity, the Motivation Class Required for The Labours, Does the Availability of Labour in Market and Competition Between Them Increase the Labour Productivity, the Training Is Important for Prevent the Work Delay in Construction Industry, the Irregular Payment Cause A Labours Strike, the Absenteeism of The Labours Affect the Day Work Schedule, the Labour Low Wage Reduce the Work Flow in Construction Industry were found to be the major problems that affect construction equipment planning and management. The overall productivity of construction is affected by various reasons. To improve productivity, it is essential to improve the performance of the construction systems.

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