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Planning, Selection and Management of Labour and Equipment in Construction Industry

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Abstract: ***Construction project refers a high stake endeavor aiming the time bound predetermined performance objective unless matching resources, planned and procured, none of the activity can be executed according to a pre-fixed time schedule. Project managers must take competent decisions under different scheduling wants (such as easy resource utilization with resource constraints) and under conditions of uncertainty that sometimes extend beyond task time. The present study is with resource (labour, equipment) scheduling for a track project with constrained durations. So in term's to avoid delay, the present study says to adopted new technologies and new equipment in the construction projects, it also help in reduction of construction cost. Here the further research is all about, how we can adopted new technologies in construction industry and how it helps in avoiding wastage of time in the project.***

Keywords: Labour management, Equipment management.

1. Introduction

The success of any project will depend on proper and efficient management of resources in perfect planned manner to complete the project within a reasonable budget, time and quality cannot be ignored.

Any two construction projects are not exactly the same they vary in many ways such as design, size, capacity, utilities, location, orientation, etc. The inefficient and timely procurement of labor at incorrect time and mobilization of machinery lacking in time, all of them causes delay, lack of quality and also affect the project cost. When we consider any project equipment is major cost for construction firms. Every year, owners, contractors, and construction companies are hit with huge amount, billions of dollars in construction, claims as a result of inefficiency factors impacting labor.

The change in the microcomputers, personal computer (PC) equipment and programming, as a result of their low expenses have made utilization of PCs in different fields of development management like task management, cost lessening, planning, bookkeeping and financing, management of materials, equipment and labor utilizing some product, for example, PRIMEVERA P6 and so on.

2. Background of the Study

The contractual worker and the proprietor pay for the additional charge for the finish of the undertaking because of postponement in huge development ventures. At the point when the fruition time of the development venture surpasses the concurred culmination time, it is known as development venture delay. The reasons for venture delays change as per and because of the work wasteful aspects, equipment wasteful aspects and so forth.

It is expected to lead point by point examination and distinguishing proof of defer factors because of work and equipment and afterward choosing the correct activities to counter postulations postpone factors inside cost and looking after quality. Deficiency and inept laborers and workers are because of the loose staff projections.

3. Scope of Work

The fundamental point is to limit the deferral in the development venture, and by implication decrease the cost of the undertaking. As development industry is the second biggest monetary segment in the nation after agribusiness. It is important factor to spare the cash and in addition time. Also, this is conceivable by greatest usage of labor and in addition receiving new advancements and types of management when vital.

4. Objectives of the Present Study

- To conduct a detail literature review.
- Resource planning and management is most important for profit and competitiveness in today's construction industry.
- Construction projects are a bit typical to achieve due to time limitations and predetermined objective.
- The main objective of the study is to find the nature and degree of wastage and to wayout the various causes of wastage.
- To understand the effects of wastages and to find a technique for maximum utilization of resources/ manpower.
- To include skilled and experienced workers in staff, because to improve the performance of work.

5. Research Methodology

The present study deals with resource (labor, equipment) scheduling for a project with constrained durations and to complete the project without time wastage but with maximum utilization of manpower.

5.1 Flow chart

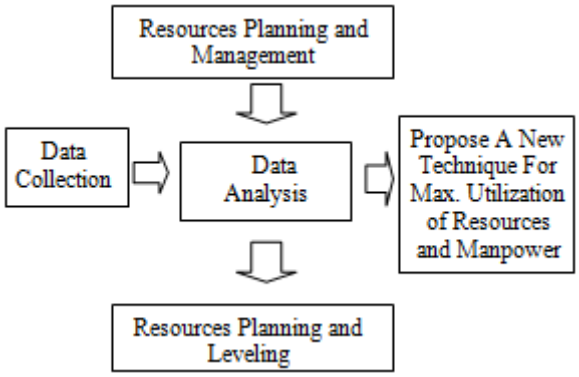

Figure 1: Block diagram of research methodology

5.2 Data collection (Case study)

- Construction Work: **JCCA CLUB (Jayanagar Civic and Culture Association)**
- Area: 1574.48sq.m (Each Block)
- Total no. of floors: G+7
- Ground floor: Parking Area
- First floor: Auditorium, Administration, Reception
- Second floor: Bar and Restaurant, VIP service area, Normal service area
- Third floor: 3cards room, Library, Gym
- Fourth floor: 2suit room, 7guest room, party hall
- Fifth floor: Badminton court, Garden, Restaurant
- Company Profile: Ansha Associates, Architects, Interiors and Structural Designers, Vyalikaval Bangalore.
- Start date of construction: 3-7-16

Figure 2: JCCA Club

- Stages of construction involved: Site cleaning, Surveying , Excavation, Pcc, Footing, Shuttering formwork, electrical work, slab, deshuttering, fixing of doors windows and frames, plastering, flooring, painting and final handover.

a) Estimated time – 18 months
b) Actual time taken – 24 months
c) Time delay – 6 months (The work of Block A and Block B was not started simultaneously, the 6month of time was wasted in demolition of previous structure, one block required around 8months of time, if both the block would start together it would be completed in 18 months, due to demolition it took 6months more)

5.3 Process for data analysis

5.3.1 Resource planning and leveling

It help the organization to make use of available resource to the maximum, the idea behind resource leveling is to reduce the resources wastage that is to stop over allocation of resources

5.4 Planning of maximum utilization of manpower

5.4.1 Types of workers

- Painters and tile installers
- cement masons
- concrete finishers
- brick masons
- stone masons
- insulation workers

5.4.2 Labor management involves

- Psychological barriers and solutions
- Primary needs satisfaction
- Management of rules and policies
- Compensation management
- Safety management
- Labor shortage management

5.5 Proposal of new technologies

1) Wall motor sprayer

Figure 3: Wall motor sprayer

Wall motor sprayer is a equipment used for plastering, the motor is filled in the circular cup shaped and sprayed to the wall, it finishes as similar to the manual plastering done by labour. The cost the equipment is between Rs 4000- RS 6000.

Table 1: Schedule of plastering

Masons	Quantity	No. of days	Cost
1Plaster mason	8-10sq.m	1day	Rs24000/floor
3mason 3helpers	2700sq.m	50days	Total 5floor:Rs1,20,000
Wall motor sprayer	50-60sq.m	1day	4800Rs/floor
2mason 2helpers	2700sq.m	15days	Total 5floor:Rs24,000
			Cost of machine :Rs5000

2) Rebar tying machine

Figure 4: Rebar tying machine

Rebar is known as fortifying steel and support steel, is a steel bar or work of steel wires utilized as a pressure gadget in fortified concrete and strengthened stone work structures to reinforce and hold the solid in pressure. Concrete is solid under pressure, however has feeble rigidity. Rebar essentially builds the rigidity of the structure. Rebar's surface is frequently designed to frame a superior bond with the solid.

- Rebar Tying: maximum 2hours (1labour)
- Rebar manual: 1day (2 labour) for single floor slab

3) Bar Bending

Figure 5: Bar bending machine

In squeeze brake framing, a work piece is situated over the kick the bucket square and the bite the dust square presses the sheet to shape a shape. Generally bowing needs to beat both ductile anxieties and compressive burdens. When twisting is done, the lingering stresses make the material spring back towards its unique position, so the sheet must be over-bowed to accomplish the best possible twist edge. The measure of spring back is subject to the material, and the sort of framing. At the point when sheet metal is twisted, it extends long. The twist derivation is the sum the sheet metal will extend when bowed as estimated from the outside edges of the curve. The curve range alludes to within sweep. The framed twist range is reliant upon the bites the dust utilized, the material properties, and the material thickness. The U-punch frames a U-shape with a solitary punch.

- Bar bending: In number of minutes (1labour)
- Bar bending manual: 5 bar benders at site

4) Modular Construction

Figure 6: Modular construction

Particular development is progressively prominent where building is built offsite utilizing a similar material and intended to an indistinguishable norms from customary on location development. It limits natural interruption, conveying parts as and when required, and transforming development into a coordinations work out. It additionally has solid maintainability benefits, from less vehicle developments to less waste. With up to 70 percent of a building created as parts, it permits a move towards "without a moment to spare" assembling and conveyance. Being used in the unified states and UK, Chinese engineers Broad Sustainable Building as of late finished a 57-story high rise in 19working days utilizing this strategy.

- RCC pillars at site: 2weeks 8pillars
- Modular method: 1 day

5) Asset mapping

Figure 7: Asset mapping

Asset mapping revolves around operational rigging, including warmth and circulating air through and cooling, lighting and security systems, gathering data from serial numbers, firmware, outlining notes of when it was presented and whom, and joins the data in a single place. The system can demonstrate manufactures dynamically a guide where the hardware ought to be presented, once the advantages are related with progressing structure using the web of things, these can be checked by methods for the web, application and other remote contraptions and systems. It empowers customers to fabricate databases of preferred standpoint execution, which can help proactive building support, and besides reduce building acquisition and security costs.

6) Photovoltaic glazing

Figure 8: Photovoltaic glazing

Building incorporated photovoltaic (BIPV) covering can empower structures to make their own specific power, by changing the whole building envelope into sun arranged board. Associations, for instance, polysolar give clear photovoltaic glass as an essential building materials, forming windows, facade and housetops. Polysolar's development is capable at conveying essentialness even on north-bound, vertical dividers and its world class at raised temperatures infers it can be increased covered or ensured particularly. And furthermore sparing cash on essentialness charges and picking up energize in collect earnings, its cost is only insignificant over traditional glass, since improvement and structure cost remain, while cladding and shading system costs are supplanted.

7) Stone crusher and Gabion walls

Figure 9: Stone crusher

Figure 10: Gabion walls

A gabion is a confine, chamber, or box loaded with rocks, concrete, or now and then sand and soil for use in structural building. What's more, the stone crusher is utilized to pound the waste rocks nearby to construct gabion dividers.

8) Polystyrene concrete blocks

Figure 11: polystyrene concrete block

Polystyrene strong pieces generally are delivered utilizing a mix of solid silica sums, reused polystyrene granules and changing pros like setting reviving operators, according to fascinating building, however every maker has an imperceptibly uncommon definition.

The pieces are lighter than ordinary concrete and in that limit can diminish required work for building block work dividers while growing the speed at which they are collected. Usages fuse as an insurance system for new and existing structures or an improvement material.

Their course of action uses fly blazing flotsam and jetsam from warm power station, which is a symptom that electrostatic precipitators gets, and silica, which adds to the thing s warm properties.

6. Results and Discussion

Table 2: Data analysis

Methods	No. of Days	Masons (per day)	Cost of 5 floors
RCC pillar	2weeks (8pillars)	2labours	Rs 6000
Modular Construction	1day		-
Plastering	50days (2700sq.m)	3masons 3helpers	Rs 1,20,000
Wall motor sprayer	15days (2700sq.m)	2masons 2helpers	Rs 24,000+Rs5000
Rebar tying manual	5days (for slab of each floor)	2 labour	Rs 3750
Rebar tying machine	Max 10hours	1 labour	Rs 468.75
Bar bending manual	10days (for slab work of each floor)	5 bar benders	Rs 23,750
Bar bending machine	No. of minutes	1 labour	Rs500 + 80,000 (or machine rent chargers)

- The time taken by the company for the activities that could be replaced is 81days and the wages payed to the labours is Rs 1,58,500
- The time taken by the activities, when new equipments and methodologies are involved is 27days and 2 hours and the wages payed to the labour is Rs 109,968.75
- The time saved is 53 days and 6hours and the amount saved from paying to the labours is Rs 48,531.25

1) **Modular Construction:** In this site we can use this method to place pillars, frame's and other aesthetic structures.
   - RCC pillars at site: 2weeks 8pillars
   - Modular method: 1 day
2) **Wall Mortar Sprayer:** Maximum 2 days and 3masons
   - Plastering **:** 10days (3masons 3 helpers) for 1floor
3) **Rebar Tying:** maximum 2hours (1labour)
   - Rebar manual: 1day (2 labour) single floor slab
4) **Bar bending:** In number of minutes (1labour)
   - Bar bending manual: 5 bar benders (As required)
5) The supervisor at site can be replaced by asset mapping.
6) The compound of the structure can be replaced by gabion walls by using the waste boulders at the site when they are crushed using stone crusher.
7) The glass frames of the windows at the site can be replaced by the photovoltaic glazing such that the building can produce its own electricity.
8) **Labour management:**
   - **Psychological barriers and solutions:** This can be solved by establishing secure and trustful environment, proper supervising, regulating health checkups, providing them safety and satisfaction.
   - **Primary needs satisfaction:** Lunch, tea-coffee and shelter should be provided on the site to labors which can helps to manage time and it also increases work capacity. Satisfactory salaries should be paid to labors per day according to the work. Bonuses, salary increment should be given time to time.
   - **Management of rules and policies:** The payment of wages Act 1936 requires that employees receive wages, on time, and without any unauthorized deductions. According to the Section 6, it says that people are paid in money rather than in any kind. The law also provides the tax with holdings the employer must deduct and pay to the central or state government before distributing the wages. On the other hand if any labor found not following contract rules, safety rules, company policies, then management can give warning for first then penalty then suspension then dismissal can be done according to government rules.
   - **Compensation management:** The workmen's compensation Act 1923 requires that compensation is paid, if workers are injured in the course of employment. No payment is made if the employee's own misconduct caused the accident unless the employee was seriously disabled or died from the accident.
   - **Safety parameters:** Train all labours in worksite for safety, medical emergency and operating procedure either on site or at a training facility. Inspect equipment to be sure it is working properly before it is used.
   - **Labor shortage management:** management should overcome this issue by maintaining peaceful and trustworthy environment and by providing sufficient wage. To occupy skilled labor rather than non-skilled labors will save time and increase strength and quality of construction.

9) Output in primavera p6: The recognized standard for high performance project management, primavera P6 handles substantial scale, exceedingly refined and multifaceted undertakings. Sort out tasks up to 100,000 exercises with boundless assets and a boundless number of target designs. Parity assets limit design, timetable, and control complex activities allot best assets and tract advance screen and envision venture execution versus design. Step involved to create project:

- STEP1: To create project name
- STEP2: To create project ID
- STEP3: To create calendar
- STEP4: To create WBS (work breakdown structure)
- STEP5: Updating the delay in project
- STEP6: To link the activities
- STEP7: Updating the dates
- STEP8: Schedule (F9)
- STEP9: To add activities and resources (If there is a delay in the project)

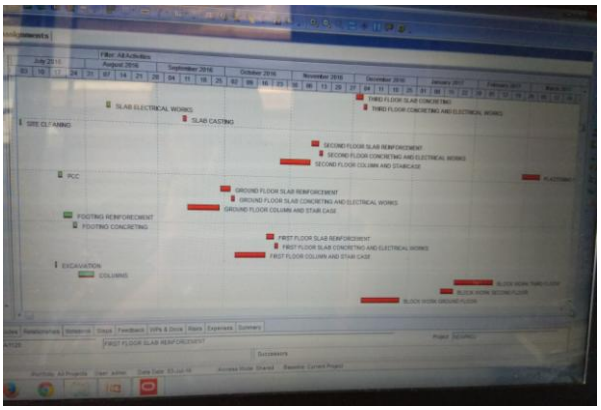

Figure12: Representation of delay in the project

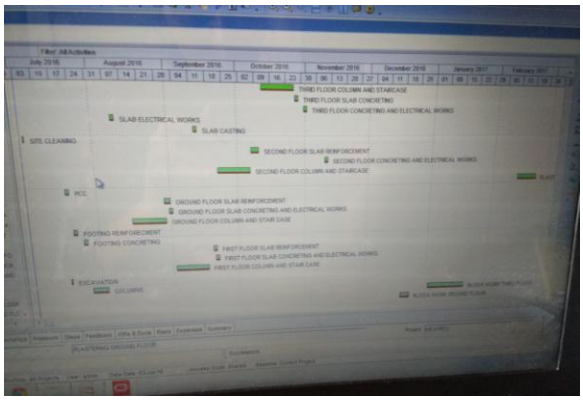

Figure 13: Representation of no delay in the project

7. Conclusion and future scope of work

- Allocation of resources for activities is necessary in construction domain to complete the project within schedule time.
- Adaption of new technologies is needed in construction project to avoid the difficulties.
- Optimize usage of resources, limit to wastage.
- To have skilled and experienced workers and staff to complete the project within schedule time.
- Developing human resources in the construction industry through proper training and classifying of craftsman.
- Provide put stock in full condition and adequate wages to the works.
- Good supervision at the site is essential and equipped task supervisor.

- Develop wellbeing condition , take after the principles and demonstrations of the administration
- Through this adaption the time saved in the construction project is 53 days and 6hours and the budget saved from paying to the labours is Rs 48,531.25

As the number of equipments and methodologies could be adapted at this construction site, that is replaced. But there are many more new technologies, innovative methodologies as well newly invented equipments, which are available throughout the country. If these could adapt in the construction industry then there will be huge decrease in the loss occurring with the contractors as well as with the owners. Because construction industry is the second socio economic development of the country after the agriculture. It will future help in reduction of the utilization time for construction of any structure to the minimum days with the maximum utilization of man power through proper planning and organization.

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