RESOURCE MANAGEMENT IN CONSTRUCTION PROJECT

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ABSTRACT

Construction industry is the largest industry next to agriculture with huge resources. Construction projects refers to high stake endeavour employing several resources such as men, materials, equipment,finance etc.achieving predetermined performance objectives using management techniques. Resource management is one of the problems faced day to day in a construction project.The construction industry exists in an environment that is both economically and technologically dynamic. Firms may find themselves financially unable to take advantage of cost saving developments in one-time period and suffer subsequently by being unable to compete with newly developed technological innovations. In addition, the industry depends directly upon the requirements of a changing society and new technological demands for its own viability.Construction projects contain numerous inter-dependent and inter-related activities. These companies face the challenge of finishing the work within scheduled time and within the budget. It requires various resources and needs time for its completion. The main factor in successful implementation of the project not only depends on the quality and quantity of work, but also largely depends on utilisation of resources.

Keywords:Management, Construction Industry, Construction Projects, Resources, Finance.

1. INTRODUCTION

These days' construction projects have increased due to high demand of infrastructure development. The fast-changing environment of the present days impose financial, legal, ethical, environmental and logistical constraints. Construction activities constitutes an important component of global economy. They interact in several ways such as technically, economically and socially within the environment as well as with other organisation, structures and systems. Even though construction projects adopt many resources, they have difficulties, risks involved in it and each work is labour intensive. There has been lack of attention given to the resource management.

Resource management is really a difficult task due to the resource driven nature of construction projects. It is carried out to plan the resources prior to the start of the work. A resource maybe manpower, material, money, equipment, time or space in a construction work. Each activity in construction is allocated with specific resources. The time and cost are directly dependent on the availability of resources. The time required to perform an activity is determined with the resources productivity and the quantity of the work for an activity. The contractor is mainly responsible to identify the interdependencies of various resources combination to perform an activity.

2. RESOURCES

A resource is an entity that contributes to the accomplishment of project activities. These includes materials, money, manpower, machinery. People, processes, and technology, also referred to as the golden triangle, are essential for successful project implementation. So, to get the work done, you need labour, and they, in turn, need materials, equipment, and a place to carry out the project activities. On an enterprise level, project resources can be human and non-human, which includes but not limited to:

- Labour: Labour or human resource forms the backbone of any project and comprises employees (part-time or full-time) and contingent staff with various skill sets required for delivery.

- Consumables & Materials: These are the consumables needed to generate the final product. The materials for a road construction project are soil, rock aggregates, binders like lime, bituminous materials, cement, etc.
- Equipment & Tools: It covers all the tangible assets (machinery, plant, equipment, etc.) and intangible assets (software, process, methods, and even ideas). These assets might change depending upon the type and nature of the organization.
- Facilities: Resources need an environment for project execution, such as land, conference room, office space, accommodation, and more.
- Finance: The most significant resource is the money required to procure the resources and carry out the necessary work. The successful implementation of a construction project not only depends on the quality and quantity of work, but also largely depends on availability of resources.

3. RESOURCE MANAGEMENT

Project resource management identifies, schedules, and oversees internal and external resources required for successful project delivery. It measures every team member's productivity and helps you take proactive measures to maximize their billable and strategic utilization. Effective project resource planning provides a clear picture of who is doing what and how long they need to accomplish the same. It helps you visualize underutilized resources or those getting rolled off from tasks and re-allocate them to suitable project vacancies.

Resource management is the process of planning, scheduling, and allocating organizational and project resources in best possible way. Its ultimate aim is to maximize your resources efficiency which in turn will fulfil project, task, or organizational goals.

3.1 Scope of resource management:

1. The scope of resource management is concerned with personnel aspects such as manpower planning, selection, promotion, training, incentives, labour productivity etc.
2. It is also concerned with welfare aspects in dealing with working condition by providing accommodation, amenities, safety, medical assistance facilities.
3. It also enhances the industrial relations among workers with managers, joint consultation, settling disputes etc.

3.2 Processes involved in resource management:

1. Plan Resource Management: It includes identifying the type and number of resources needed to meet the deliverables. It also determines the approach you will use for project resource management.
2. Estimate Activity Resources: Determine resources needed for carrying out project activities. Apart from the type and number, other selection criteria such as qualification, experience, and cost are defined.
3. Acquire Resources: After estimating the project resource requirements, you must decide when and how you will acquire them. Formulate a procurement management plan for purchasing tools and equipment or publish the project team positions to fulfil the requirement.
4. Develop Team: Once you have acquired the resources, you need to ensure they are skilled and trained to meet deliverables. It applies to human resources who seek career development opportunities and an enriching work experience.
5. Manage Team: For managing project resources efficiently, project managers regularly need to check employee performance to enhance their productivity.

4. MATERIAL MANAGEMENT

Materials constitute large fractions of the overall project cost. Commonly used materials in construction industry from civil engineering perspective, are concrete, water, steel, bitumen, admixtures, consumables (oils, lubricants, diesel), pipes.

Material Management is defined as planning, identification, procuring, storage, receiving and distribution of materials. The purpose of material management is to assure that right materials are in the right place, in the right quantity when needed. The management of materials should be considered at all the phases of the construction process and throughout the construction and production periods. This is because poor materials management can affect the overall construction time, quality and budget. It is important for planning and controlling of materials to ensure that the right quality and quantity of materials and installed equipment are appropriately specified in a timely manner, obtained at a reasonable cost, and are available when needed.

4.1 Functions of material management:

1. Efficient materials planning
2. Buying or purchasing
3. Procuring and receiving
4. Storing and inventory control
5. Supply and distribution of materials
6. Quality assurances

4.2 Activities involved in materials management:

1. Materials Requirements Planning
2. Purchasing
3. Incoming materials quality & quantity check
4. Inventory Control
5. Storage
6. Materials Handling
7. Transportation
8. Scrap & surplus disposal

4.3 Inventory management:

Inventory is defined as comprehensive list of items which are required for manufacturing the products and to maintain the plant facilities in working conditions. The term inventory includes materials; raw, in process, finished packaging, spares and others stocks.

Inventory Management is primarily about specifying the size and placement of the stocked goods. It is the system and processes which identifies the inventory requirements, set targets, provides replenishments techniques and it reports the actual and projected inventory status. Inventory management is required at different locations within a facility or within multiple locations of supply network to protect the regular and planned course of production against random disturbance of running out of materials or goods.

4.4 Inventory control:

Inventory control is a planned approach of determining what to order, when to order and how much to order and how much to stock so that costs associated with buying and storing are optimal without interrupting production and sales. The inventory control system strikes the balance between the loss due to non-availability of the item and cost of carrying the stock.

5. MANPOWER MANAGEMENT

Labour or human resource forms the backbone of any project and comprises employees (part-time or full-time) and contingent staff with various skill sets required for delivery.Manpower management focusses on estimating the size of workforce, division into functional teams and scheduling the deployment of manpower during various stages of the project.

5.1 Types of labour:

- Unskilled Labour:
  i. Majdoors
  ii. Beldars
  iii. Bhisti
  iv. Housekeeping labour
  v. Helper
  vi. Material shifting labours.
- Skilled Labour:
  i. Masons
  ii. Carpenter
  iii. Painters
  iv. Electricians
  v. Plumbers

6. MONEY MANAGEMENT

Money management is the process of managing money, which includes investment, budgeting, banking and taxes. It is also called as investment management. Money management is important because it helps in improving the profitability of organizations; increases the overall value of the firms or organizations; provides economic stability.

6.1 Main elements of capital cost include:

i. Engineering and project management cost
ii. Construction materials, manpower, equipment cost
iii. Management and supervision during construction
iv. Land acquisition including assembly holding &improvement
v. Construction financing
vi. Inspection & testing

6.2 Sources of financing:

i. Equity capital
ii. Preference capital
iii. Secured debentures
iv. Term loans
v. Capital subsidy & development loans

7. MACHINERY MANAGEMENT

Machineries are generally used to reduce the no of labour, to reduce time of the construction, to increase the effectiveness of the project. Machinery selection is mainly depending upon;

i. Weather to purchase or to hire the equipment.
ii. Purchase is generally preferred when the equipment is needed for the entire project.
iii. Hiring is generally preferred when the cost of the machinery is high to purchase.

iv. It is better to use the equipment which is available at the construction site.

Common Equipment Used During Construction as Follows;

Table 1: Equipment Used During Construction

Sr. No.	Job/Activity	Typical Equipment Used at Site
1.	Excavation/loading	Crane, dragline, back-hoe, pile driver & shovel
2.	Compaction/grading	Sheep foot roller, grid roller, vibratory roller & steel wheel roller
3.	Drilling	Percussion drills, rotary drills & tunnel boring machine
4.	Lifting/ erecting	Derricks & boom type tower cranes
5.	Concreting	Batching and mixing plant machinery, mixers, transit mixers & pumps

7.1 Procurement of equipment:

An equipment may be purchased, rented or leased. Purchasing is preferable if the equipment is essential for key operations and is expected to provide service for long time. Acquiring an equipment on rent is preferred when;

i. Trying an equipment before buying it
ii. If the requirement is for short duration
iii. Operating only in case of special projects
iv. If owned equipment is out of service

Leasing an equipment is preferred if the equipment is expected to be used frequently and sufficient resources are not available to purchase.

8. PROJECT RESOURCE PLAN

For every successful project, the journey starts with creating an efficient project resource plan. Using resource management solutions, project managers can plan, organize, and manage the project resources effectively. Let's take an example for better understanding. Suppose a bridge construction project will start two months from now. As resources are critical drivers of project success, the project manager needs to create an efficient project resource plan.

Here are the essential steps to formulate one:

1. Estimate resources required for the project: Before starting the project, it is critical to define resource requirements. The project manager identifies the type and quantity of resources. Depending on the resource type, grades or skills can also be determined. For this bridge construction project, he/she also needs to establish cement grade, size of cranes, kind of steel, etc. Similarly, the skills, roles, experience, etc., are predefined for human resources such as civil engineers, architects, contractors, supervisors, and construction workers. Once the resource estimation is complete, the project manager informs the concerned stakeholders and takes their concurrence. He/she can then raise resource requests by filling and submitting the resource requisition form on the tool. Although done initially, one must note that resources can be requested in a staggered manner, depending on the project requirement.
2. Request resources: Once resource estimation is completed, the project manager requests the resource manager for fulfilment. An automated resource requesting helps streamline the process. Modern resource management solutions allow project managers to specify the required skills, experience, qualifications, cost, and project timelines. This request reaches the inbox of the resource manager in

charge, who starts planning for the same. The whole process is documented and remains auditable, which eliminates any process-related confusion or conflicts.

3. Identify and estimate the shortfall: After receiving the resource request from the project manager, the resource manager starts planning for fulfilment. But first, he/she needs to analyse the existing resource capacity. The resource manager looks into all the resources matching the requirements across the enterprise. Using appropriate filters such as role, competency, location, and more on the resource management tool, he/she can quickly find all the relevant resources and their availability. Demand capacity planning helps to identify and estimate the excesses or shortfalls accurately.
4. Hire or retrain resources as needed: After identifying the excesses or shortages, the resource manager in charge can apply appropriate treatments to bridge the capacity gap. Depending upon the project's duration and nature, stakeholders can decide whether to hire permanent employees or a contingent workforce. If there is an excess, adjusting project timelines, training, reskilling, or selling excess capacity helps bridge the gap. Employees can be encouraged to acquire more skills. People on the bench and project vacancy reports enable resource managers to identify available employees. If the resources match the minimum qualification criteria, learning new skills with shadowing (on-the-job training) opportunities increases billability.
5. Publish requirements to empower resources: Studies have shown that employees are engaged and more productive if they are fully empowered to carry out their responsibilities. Since human resources are essential assets for most organizations, involving them in choosing projects of interest boosts productivity. They are motivated and hence feel responsible for accomplishing their respective tasks. Resource managers can publish open positions within the resource management system. Every relevant resource matching the role and belonging to the required organization structure like the team, department, location, etc., are notified. Accordingly, they can revert to the open positions and show their interest in joining the project team. The resource manager in charge can take appropriate action in selecting the ideal resource pool.
6. Seek approval from project/ line managers: Once the resource manager in charge selects the team members, he/she seeks approval from the project manager before allocation. The project manager can either approve all recommended resources or request changing few team members. Accordingly, the resource managers start looking for more suitable resources befitting the requirements. The entire process repeats till both the concerned stakeholders agree on the proposal. The project manager then approves the mutually agreed resources, and the resource manager starts the allocation process. In case there is a performance issue with a particular resource, the project manager can roll the person off and ask for a replacement during the project life-cycle.
7. Allocate appropriate resources to tasks: The resource manager's responsibility ends after the resources are accepted within a project. At this stage, the project manager assigns various tasks to the selected resources. He/she creates a complete task list and its dependencies as per the Work Breakdown Structure (WBS). While scheduling team members, the project manager ensures that no one is under or over allocated. It improves project members' overall productivity, reduces burnout, and helps meet the project's objective.
8. Manage the project delivery: Project resource management is an ongoing process and doesn't end after the initial resource allocation is complete. The project manager allows a buffer for any potential risks that can affect resource availability and complete projects with fewer members.

8.1 Benefits if implemented resource management

1. Maximizing resource efficiency: Resource utilization

Resource utilization is all about making the most out of the resources available to you. It is the percentage of the resource's working time (Busy time) within a certain time period (Available time). The easiest way to understand the concept is through a formula;

i.e. Resource utilization = Busy time / Available time

This is an important metric in understanding whether or not your resources are working at maximum efficiency.

2. Getting a bird's eye view of your project: An overview

Contemporary project management is tricky. Offices in different locations, a number of ongoing projects, hundreds of different resources with different tasks. Without resource management, it's a catastrophe waiting to happen. Effective resource management strategies will give you an overview of everyone and everything. And an overview gives you control over what's going on.

3. Preventing miscommunication mishaps: Transparency

With resource management, every (human) resource is able to view their tasks. Every project manager can see how resources are allocated. This means planning is transparent both ways. Resource management with a central resource management tool will provide you with better transparency. Helping to avoid such misunderstandings.

4. Predicting the future: Foreseeing and avoiding problems

Managing resources can really help you predict the future. And unlike the others, it can be a lot more reliable. It turns out, planning your resources gives you the ideal opportunity to understand the actual timeline of a project. The phases, the tasks that need to get done, and the resources that are required to make miracles happen. Planning lets you account for all of this, before they even occur.

5. Taking control:

As a project manager, you not only need to see what's going on with your various projects, but you also need to have control about what's going on. Being able to track your resources' progress is essential. But without the correct tools to help you, you can't actually take control and manage what needs to get done.

9. APPLICATIONS

Construction resource management is used to:

i. Track resource availability.
ii. Relocate resources in response to project changes.
iii. Ensure project teams have the right skills and experience.
iv. Optimize resources time, effort and cost.
v. Identify and resolve resources conflicts.
vi. Forecasting future staffing requirements.

10. CONCLUSIONS

Resource management is a skill set that every project manager must master, and with right tools and techniques, required project is easily achievable. Allocation of resources for activities is necessary in construction domain to complete the project within the scheduled time.

Resource management helps meet your project goals using resources intelligently. Proper planning of resource management can help to avoid any delays of work on site and reduce any extra cost for a project.

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