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Cost Overrun and Delays in Construction Management by Using Primavera

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Abstract: ***Project management is the practice of organizing, planning, carrying out, overseeing, and wrapping up a team's work in order to accomplish particular objectives and satisfy particular success criteria within a given time frame. Each project is unique, and managing it is necessary to meet the project's need for increased productivity. Notwithstanding the centuries-long evolution of the construction industry and the decades-long quest for novel solutions by researchers, a variety of obstacles still need to be overcome in order to improve the speed, safety, affordability, and accuracy of the construction process. Utilizing a program called Prima Vera p6, which is a tool for project planning and progress tracking, the study focuses on an ongoing residential building construction project (G+5) . This project is a G+5 storey residential building with a rectangular shape RCC framed construction with a total size of 1391 Sq. Mtr. And the floor height is 3m. We used Primavera to calculate project quantities, schedule, and estimate the project. We created a Gantt chart and a network diagram for this project and completed it in a timely and cost-effective manner. It gathers all relevant data from the relevant agencies and closely monitors the work processes. Through our work on it, we have learned a great deal about the challenges that businesses encounter on a daily basis. Though every project is unique, as I've already shown, we may learn from our mistakes and prevent them in future endeavors. Using Primavera P6, a project management tool, a comparison of the original and actual time and cost is conducted in this study. The project monitoring process itself might not be completed effectively even with well-established planning and policies.***

I. INTRODUCTION

Cost overruns and delays in building projects have long been an issue in the construction and engineering industries. Increases in both time and expense in big public construction projects. Optimistic schedule and budget expectations have been proven to reduce the degree of quality and productivity during the building stage and in the final end-product. To reduce such overruns, the existing corpus of knowledge tends to focus on crucial success elements such as time and cost as discrete notions of different project kinds and geographical locations with minimal context. A successful project is defined as the capacity to satisfy both the contract's budget and timeline. However, in addition to earlier research, we must incorporate quality into the argument of time and cost as connected notions, since all three have been prominent in the building literature, sometimes known as the "iron triangle." Comprehensive research concentrating on time, cost, and quality as interconnected concepts are thus required to establish major disparities between the three ideas in the "iron triangle" and to expand the current body of knowledge.

Increased pre-project planning work might be a viable answer to the essential success factors influence on building projects. The advantages of employing pre-project planning include higher profit, less risk, and improved quality.

In comparison to a reactive approach, increased construction planning allows the contractor to be more proactive in responding to crucial elements affecting the project. The benefits of realistic cost and time planning prior to design, as well as its effectiveness throughout the construction stage, include enhanced project outcomes, user satisfaction, and lower project cost and duration. Identifying and testing for substantial variances in the impacts of the essential success variables on time, cost, and quality is thus critical to deal with the issues in the pre-project planning phase to ensure the project outcome.

On-time completion of projects is an evidence of an efficient construction sector. In reality, a project is deemed ‘successful' if it is finished on schedule, within budget, and to the required quality. When projects are delayed, they are often either prolonged or expedited, incurring more costs. Many projects, much to the chagrin of owners, contractors, and consultants, incur lengthy delays and thereby surpass initial time and expense projections. The building process is fraught with uncertainty and unpredictability. Delivering a project on time does not happen by hoping that the deadline will be reached.

To design and execute a successful project, three aspects must be considered: time, money, and quality. Construction clients are generally concerned about quality, timeliness, and cost. However, the bulk of construction projects are bought based on schedule and cost limitations. Poor management techniques are commonly related with cost escalation and time overruns.

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As a result, effective project management is dependent on the management tools. Managing resources includes overseeing personnel, equipment, finances, supplies, and techniques. While some projects are successfully and economically managed, others are poorly managed, resulting in significant delays and cost overruns that have a detrimental impact on the economy.

II. OBJECTIVES OF STUDY

1) To highlight the significance and goal of keeping an eye on building work.
2) Examining methods or instruments for assessing building project management (Primavera P6).
3) To offer guidelines to contractors so they can update the project.
4) To identify the crucial tasks that significantly impede the project, first from the client's perspective and then more broadly.
5) To keep an eye on the planning, strategies, and resources currently in use in order to accomplish objectives and finish a project within budget and on schedule.
6) To assess the efficacy of the current cost monitoring and control strategies used by contractors.
7) Evaluating if the contractor's methods of project organization are appropriate for keeping an eye on and controlling costs.
8) To provide a broad construction management evaluation system's specifications, structure, and appropriate parts.

III. METHODOLOGY

Following a review of the literature to determine how IT is used in civil engineering and to develop goals that take software's PRIMAVERA into account, the following approach has been thoughtfully created to meet these goals.

1) *Collection of Literature:* I have looked through a lot of papers that are pertinent to my issue, researched them, and selected the points that are truly significant to my investigation and included them in my study.
2) *Project Selection:* In order for me to thoroughly analyze the activities and offer any necessary recommendations, it is crucial that I choose a project that can begin and be completed within the time limit of my research. I have chosen an ongoing project at Golf City, Lucknow.
3) *Data Collection:* Gathering information for the project I have selected is a difficult work since the people involved do not want their project to be studied. However, thanks to my connections with the project personnel, I was able to gather the necessary information.
4) *Prima Vera P6 Planning:* Following the collection of data from various sources, a planning schedule with budgeted costs is created.
5) *Planning and Monitoring:* Since this is an item rate contract, any increase in the quantity of work may result in an increase in the real cost of an activity. Therefore, periodically review the activities and record the value of performed quantities.
6) *Observation of the Entire Project:* By looking at the project, suggestions are made to prevent similar issues in the future.

A. *Steps Involved In Monitoring And Controls Of Project Are*

Establishing the perfect timetable Any project's initial step in creating a schedule is gathering all of the project's data. Primavera can then be used to carry out the succeeding phases.

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

1) *Factors:* Even if two identical infrastructure projects are similar, the amount of money spent on them will never be the same. Despite technical factors, variances will still occur due to the wide range of economic and client preferences. The cost of the actual materials, the cost of the equipment used in construction, the cost of labor, and—most importantly—the cost of the land in the area where the project is being completed determine the project's final cost. Depending on the needs of the client and how precisely his concept is realized in his vision, the building timeline may change. These expenses and times will change based on the following elements that are covered:
2) *The Project Specification:* The project's design and physical state are specified in its specification. The necessary number of rooms and anticipated occupancy rate for residential structures will depend on factors such as room height, floor plan size, internal and external design, floor loadings, heating and lighting requirements, and specification of total rooms. The greater the scope of the project and the more intricate the specification, the higher the completion cost. For instance, the layout and specifications of a hospital, business centre, institution, and lodging facility varies greatly from one another.
3) *Location of the Building Project:* The project may also be impacted by site location and geographic reality. For example, if the project is being carried out in an area where coarse aggregates and sand dust are readily available, the expense of shipping these raw materials will be lower. Due to the general market conditions and delays in material supply, land pricing, building material

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costs, and design standards differ significantly from place to place and location to location. It will be expensive to transfer labour and materials for a project if it is located distant from the local market and has a difficult access point.

4) *Repairing or New Buildings:* In general, the cost of establishing new infrastructure is higher than that of maintaining existing structures. However, it is sometimes noted that replacing infrastructure will be more expensive than fixing existing infrastructure. This is the original situation since the costs associated with land unrationing, providing services, etc. are not included in the cost of repairing and altering existing structures. However, in the event that the infrastructure is severely damaged, it is advisable to build new infrastructure even though repairs will be made.
5) *Project Timescale:* The longer a project lasts, the higher its cost will usually be. The type of project and its specifications determine the project timeframes. An undertaking takes longer to finish the larger it gets. However, if a site is monitored, it can end sooner. A project's individual activities are typically dependent on one another, and if one is delayed, it will inevitably influence the others. A project's length will have an effect on its budget as well.
6) *Characteristics of Site:* The original cost and projected time of a site might be influenced by its terrain, soil profile, and ground water level. Bad ground conditions have an especially large impact on the quantity of excavation and foundation work needed. It is impossible to obtain precise project cost estimates in situations where ground conditions are unclear without first conducting a soil assessment.
7) *Inflation of Project Costs:* The cost of labor, materials, and equipment may increase or decrease depending on the region of the nation, and contracts between suppliers and subcontractors may include varied provisions for inflation protection that are negotiated with the customer. Interest rates rise as a result of overbudgeting brought on by commodity price inflation.
8) *Price Fluctuation of Raw Materials:* In developing nations where prices are subject to change, it is challenging to determine the exact cost of resources.
9) *Underestimating the Cost of Construction:* When construction parties obtain project permission, they occasionally obtain contracts at a lower actual cost than anticipated, and as a result, they have financial difficulties as the project moves forward.It is a bad practice that causes the project's costs to exceed budget.
10) *Change in Exchange Rates:* If supplies or other project components must be acquired from overseas, the change in exchange rates will have a significant impact. The project's cost could rise, which would inevitably result in cost overruns, if the foreign exchange rate rises above expectations.

A. *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) *Payment Delays Brought on by Interim Documentation:* The majority of contractors in this project have trouble being paid for their finished job. The numerous departments involved in the intricate and drawn-out bureaucratic procedures that verify and recheck all paperwork related to finished projects in order to prevent any financial damage to the organization. It usually has an adverse effect on the cash flow of the contractor. As a result, the contractor is forced to conclude the project and go on. This has a detrimental impact on how long the project takes to finish.
2) *Modification Orders:* The majority of variation happens when the project is being built. Variations in the orders from the client officials in this project require time. It has an impact on the timeline, duration, and pace of construction, leading to delays, rework, and job extension.
3) *Cash Flow:* The most important requirement for finishing a project and beginning a new one is cash flow funds. The likelihood of the project being terminated increases if there are delays in the cash flow, which in turn impacts the cash flow of the contractors. Inappropriate cash flow has an impact on the project as a whole and all of its stakeholders. In this project, for example, the client frequently pays the primary contractor, but the main contractor fails to pay their subcontractor, who is responsible for a significant portion of the work.

B. *Additional Costs*

1) *Additional Works*

First Added Works Throughout the building phase, additional activities are required as a result of design changes. A specific project must be completed, so the extra expense will be necessary. Additional funding and labor are needed for this, and planned adjustments must be made in between the project phases.

2) Fluctuations Indian Construction Projects

High rates of inflation lead to increases in labor and service expenses, as well as material prices. This causes fluctuations. For the duration of its phase, fluctuations are highly typical. The introduction of new levies, such as the GST, also causes fluctuation. Since India is not a developed nation like the US dollar, British pound, etc., material prices will fluctuate greatly to reflect changes in the currency rate. It is expected that tenders quoted in India would experience volatility.

3) Inaccurate Estimates / Provisional Sums

For the client, inaccurate project cost estimation might have serious consequences. When sufficient investigations are not carried out and all work items are not accurately priced in the Bills of Quantities (BOQ) prior to the start of construction, the true costs of these work items are discovered during the building process. These expenses, which are typically added to the tender price and result in significant cost overruns, are typically greater than the tentative estimates permitted in the BOQ.

4) Adversarial Relationship among Parties

Relationship problems between the Contract's parties may arise from cost overruns. Cost overruns may cause a sharp decline in construction activity, damage to one's reputation, and make it more difficult to obtain project financing in the future. Not to be overlooked are further consequences of cost overruns:

a) The quality of the workmanship is low.
b) A contractor impacted by the client's inadequate financial flow.
c) Fair and equal distribution of resources.
d) The contract for this study is an item rate contract; the contractor is awarded the contract based on item rates and quantities, with the architectural team identifying the amounts of various products.
e) They have used the layman's method to create a timeline in Microsoft Excel for the project's completion.
f) I chose to utilize Primavera P 6 for this project after choosing this topic for my study because I wanted to find out how the current approach and the layperson technique would reduce project costs and time.
g) This software also shows us where we started with our project, how far we have come, and how much time and money we still have to go.
h) If we are falling behind in the previous action, we should attempt to shorten the actual duration of the following activity. This will save both our time and money, as time is closely correlated with money.
i) Since this is an item rate contract, the contractor must ensure that he will reduce his indirect costs by increasing his time savings.
j) The primary goal of any contractor is to complete their work within the allotted time frame, as this results in a satisfied clientele who will refer you to their friends and family.

V. RESULT AND DISCUSSION

This section examines the primary causes of cost and schedule overruns, which can stem from a variety of sources and are dependent on the project that was selected. The project under investigation is behind schedule due to inadequate planning and financial constraints.

The results were gathered based on the questions posed to the site engineers, subcontractors, and project managers. It is crucial to confirm that the site workers and the architecture company were aware of the research definitions when they provided the data for this example. The responses from the conversation provided by the site engineers, project managers, subcontractors, and client representatives are examined.

Some information about the business was provided by the respondents, and online research was used to confirm the information. Ongoing construction is tracked in a single project management software file, which is updated daily and cross-checked against the timetable that was previously established. Four interviewees admitted to holding somewhat structured meetings. Accordingly, the entire research design of this thesis centered on the four meetings that the organization's two task administrators reported, as well as the members' post-event review. We discussed two distinct activities—one with excellent execution and the other with subpar performance—with each of the undertaking administrators.

Based on the present case study the following results are determined. The various factors are tabulated as follows. Which indicates the data representation to achieve the following result,

Activities	Actual Cost	Predicted Cost	Difference
Foundation	15,00,000	20,00,000	5,00,000
Ground floor	12,00,000	15,00,000	3,00,000
First floor	12,00,000	15,00,000	3,00,000
Second floor	12,00,000	15,00,000	3,00,000
Third floor	12,00,000	15,00,000	3,00,000
Fourth floor	12,00,000	15,00,000	3,00,000
Fifth floor	12,00,000	15,00,000	3,00,000
Roof	7,00,000	8,00,000	1,00,000
Finishing	42,56,130	50,00,000	7,43,870
Total amount	1,25,76,365	1,68,00,000	31,43,870

The contractor had supplied us with the information that the actual duration of the project is 365 days and the total cost of the project was summed up to Rs.2 crs (approx.).

But the same project when efficiently planned using primavera software could be completed in only 265days as shown in planned schedule with the total project cost assuming up to Rs.1 crs (approx) as obtained from estimation of cost.

Therefore, it is concluded that a project could be completed 79 days earlier and would save Rs.31, 43,870.

Hence our objective of our project which were to complete the project in stipulated of time minimum resources and to maximize the resource material and equipment have been achieved.

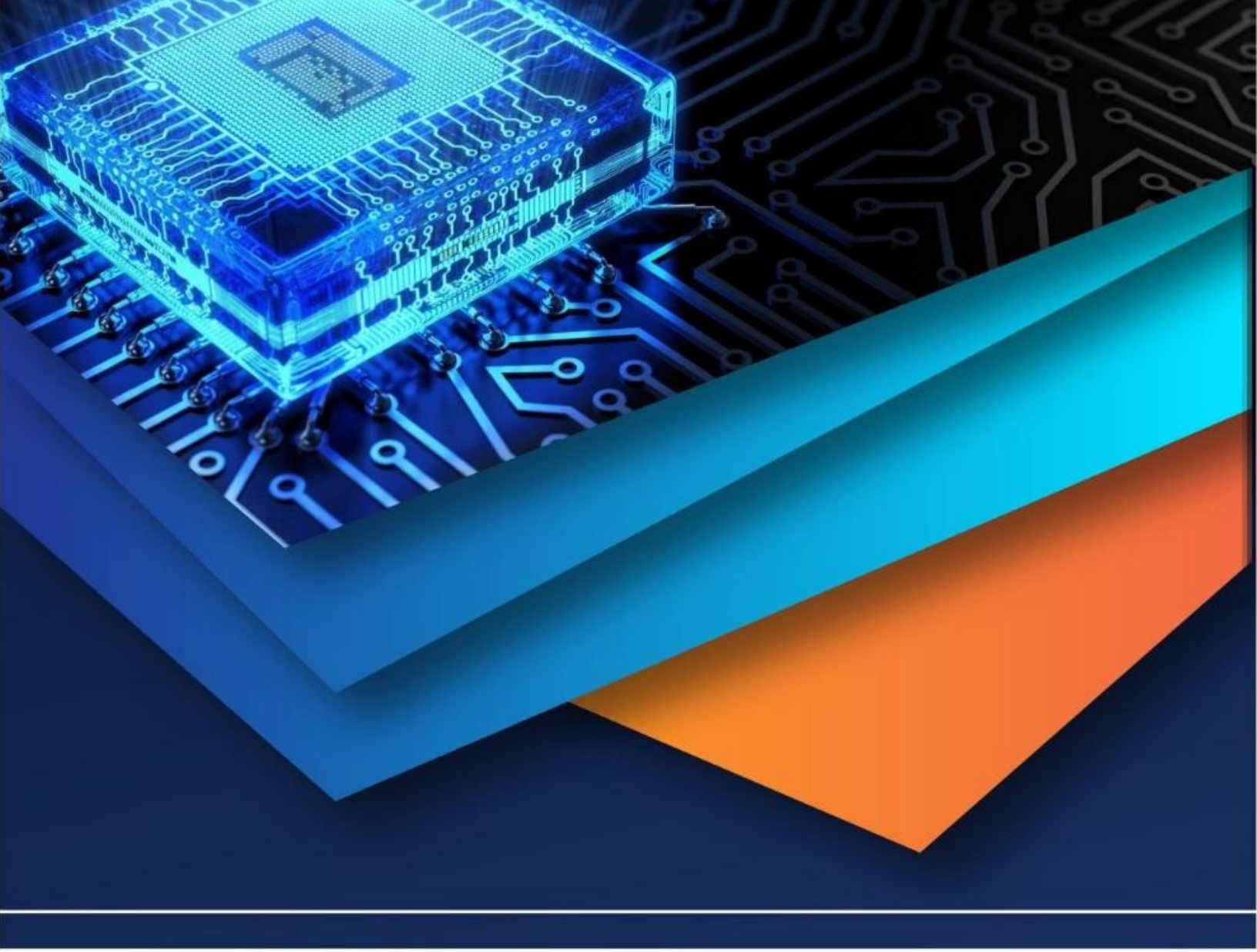
VI. CONCLUSION

1) We need to make sure the project is finished on schedule in order to save costs.
2) Adequate planning is essential for timely project completion.
3) To secure the greatest number of projects available in the market, contractors must guarantee a record of timely completion.
4) By using a basic planning tool, the contractor for a project could be completed 79 days earlier and would save Rs.31, 43,870.
5) Our objective of our project which were to complete the project in stipulated of time minimum resources and to maximize the resource material and equipment have been achieved.
6) The contractor is responsible for guaranteeing that the teams required to finish a specific task will be accessible on schedule.
7) Never select a subcontractor whose bid is excessively expensive or too low in relation to the total cost of completion.

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