

Estimate Costs Management in Construction Projects

Mahmoud Fadhel Idan*, Sara Nazar Dheyab

Al-Ma'arif University College, Civil Engineering Department, Al-Ramadi Road, Al-Ramadi 31001, Iraq,

E-mail: dr.mafa57@gmail.com, sara.nazar@auc-edu.org

Abstract:

The estimate costs of management in construction projects were studied in this paper, which gave achieved understand well by applying a principle cost estimate management. the importance of this study comes from considered the Construction projects are one of the most exposed projects to increase realistic costs over expected cost , Because of the many unexpected changes that occur, which is one of the areas of knowledge of project management. The general concept of project management, the cost management, explained its processes, and Highlight the concept of cost estimate management was discussed. In addition to make questionnaires showing the steps of apply this principle in order to know the extent of its application in the construction projects.

Keywords: *Management, cost, Estimate, Project, Construction, Pillars.*

Nomenclature

- A Highest weight
N total number of respondents
Rii Relative importance index
SD Standard Deviation
W Weight given to each indicator

1. INTRODUCTION

Construction projects are considered to be the most important pillars of any society therefore it is necessary to pay attention to them and examine their constantly changing circumstances, The construction projects sector is one of the most vulnerable to changing circumstances because it is directly related to changing social , Economic and cultural conditions , and The construction projects are based on three pillars : cost, quality and time, so the success of any project is based on these pillars. The project is considered successful if it constructed with the highest quality, the lowest time and the lowest cost, hence, the success of the project is closely related to the cost estimate of the project. projects and construction projects in particular may be subject to financial loss or economic failure due to inaccuracy in the calculation and estimation of the costs expected, when the implementation of the project may be the real costs greater than the expected costs and therefore the financial loss of the project, must be understood and study the cost estimate which is an important

part of project cost management , By studying and understanding the principles and correct steps of the concept of cost estimation management, which includes cost estimation, budget determination and cost control .

1.1. Research Objective

The aim of the research is to know and understand the cost management as well as to know the steps of its application on construction projects.

1.2. Research Problem

Most projects neglect to study and apply the cost management principle, which leads to the emergence of additional costs.

1.3. Research Methodology

This study will collect information related to the subject of the study by following the method of describing the analysis of literature and previous studies related to the subject of cost management, in addition to submitting a questionnaire and distributing it to the experienced persons in this field then analyzes the results to see how well they are applied in the projects and find out what are the correct steps to apply this principle.

2. THE THEORY OF PROJECT MANAGEMENT

2.1. Project:

The project can be define as a set of interconnected activities restricted by a specific scope, schedule and budget to provide the capital assets required to achieve the Organization's strategic objectives.[1]

Paul Newton was defined the project as "A temporary endeavor undertaken to create a unique product, service or result".[2], also the project can be defined as Achieve a definite goal, including a series of activities and tasks which expend resources. They should be done within a group of requirements, with specified start and finish dates .[3].

2.2. Project Management

Project management is to use available knowledge, skills, tools and techniques for project activities to achieve project objectives. Project management is implemented through certain processes such as: initiating, planning, executing, controlling, and closing. T. Vasista was defined the Project management as "the process of controlling project objectives"[4] . The project management's function is to identify the work and resource requirements, as well as the necessary planning for the execution the work and the monitoring of progress, and the necessary adjustments to stay

within the plan.[3]. Project management also looked through some operations processes involved. These processes can be organized into functional areas, such as the following : [2]

- Managing the Scope,
- Managing the Costs,
- Managing the Schedule, and
- Managing Risk, etc,

The function of project management is to make sure that resources are used effectively to achieve the goal that is defined within certain criteria. Criteria are the group of rules or standards by which decision is made; while factors are the group of conditions, influences which give the result. Two criteria to determine the project success are: completion and satisfaction [3].Therefore, we note from this that cost management is one of the main operations of the project operations, so it must be understood and explained in a detailed and clear, and the following will be highlighted the concept of cost management .

2.3. Project Cost Management

Cost can be defined as expenses spent by the contractor for work, services, materials, utilities, etc., as well as overhead and profits of contractor. while the Cost management is the process by which the costs and expenditures that are formally spent on the project are determined, approved and paid [3].

The Cost is one of the key considerations throughout the project life cycle and can be considered as one of the most important features of the project and the project is considered successful if its objectives are met within the specified cost [5]. The Project cost management is to ensure that the project achieves the objectives required in condition of financial performance, The managers ,contractors and designers are responsible for all aspects of the project in order to ensure that the performance does not exceed the budget [6]. Project cost management included the process of estimating , budgeting , and controlling costs to complete the project without exceed the budget , cost management processes include the following processes , and as illustrated in Figure(1) [4]:

- 1) Estimate cost: Is the description Approximate of financial resources needed to complete project activities.
- 2) determine the budget : the processes of gathering the estimated costs of individual activities or packaged the work to establish an licensed cost baseline
- 3) Control cost: the processes of monitoring the project's state to develop the project budget and managing changes to the cost baseline.

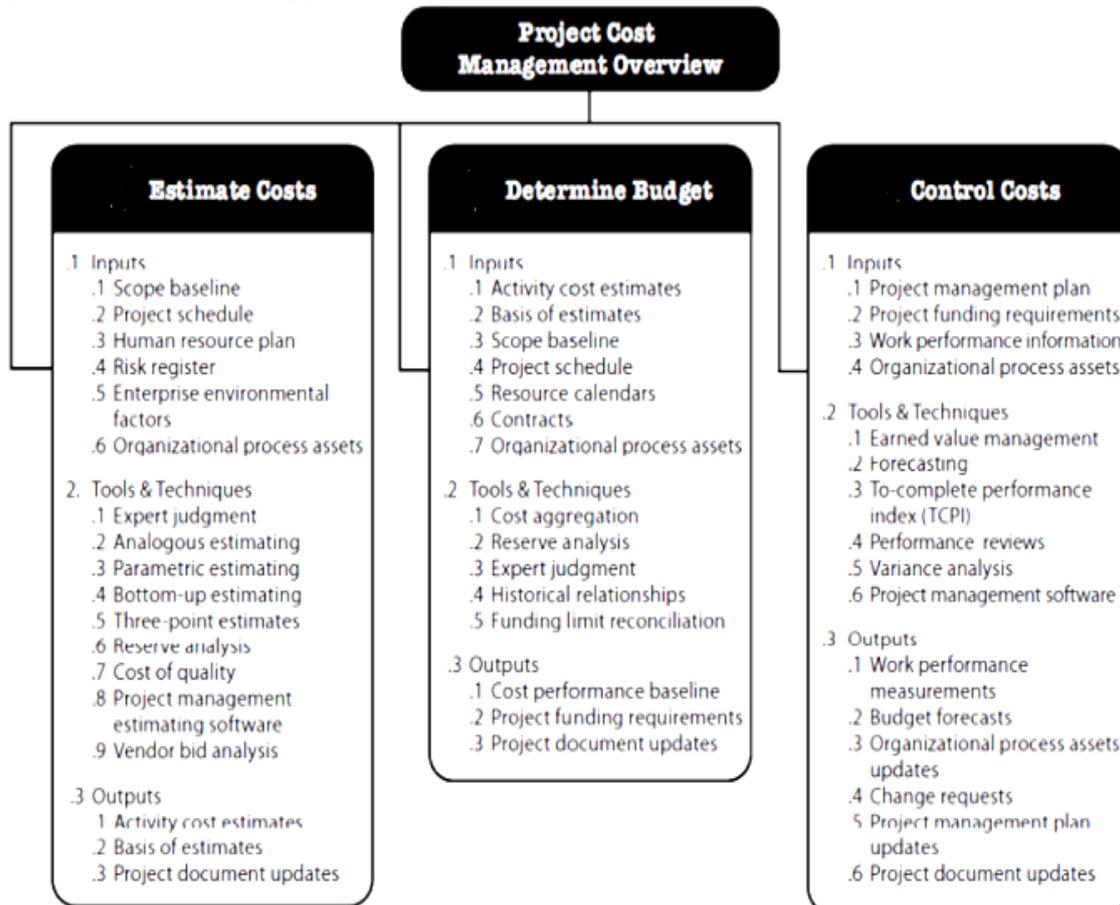


Figure 1: The Major Processes of Project Cost Management [4]

2.4. Estimate Project Cost

Estimate cost is very difficult and demanding mission, especially in the early phase of project Implementation, where the documents are still only designed. Knowledge the cost of construction works Depending on the previously finished residential and commercial buildings is an important element to estimate and control the costs of comparable future projects, in order to achieve the major objective of estimate cost[7]. Chitkara was defined the cost estimation as “a continuous process. it calls financial commitments at various levels and by various agencies involved in the project ”[8].

Estimation is the scientific method to know the approximate cost of a construction project before fulfillment the work. and It is fully different from calculation of the real cost after completion of the project , and the Cost estimation needs a overall Knowledge of the construction processes and cost of labor and materials in addition to the experience, skill , foresight and good judgment. Cost estimate of construction job is the possible cost of that job as computed from specifications and plans. For a good estimate the, real cost of the suggested work after fulfillment should not differ by more than 5 to 10 % from its approximate cost estimate, as long as there are no unusual, unexpected circumstances.[9].

The purpose of estimating is to determine the required forecast costs in order to complete a project in the specifications and contract plans. The estimator can estimate the cost in sensible accuracy for a given project.[10]

3. DATA COLLECT

This section describes the used method to collect the data since the data collection tool is closed questionnaire. 40 questionnaires have been distributed to a number of experienced engineers in different projects but only 37 questionnaires were recovered and were actually valid for use. We explain below a description of the demographic variables of the study, sample and data. Fig.2describes the labor sector where 56.75% of the sample working in the mixed sector, followed by 24.32% of the sample working in the government sector, and only 18.91% working in the private sector.

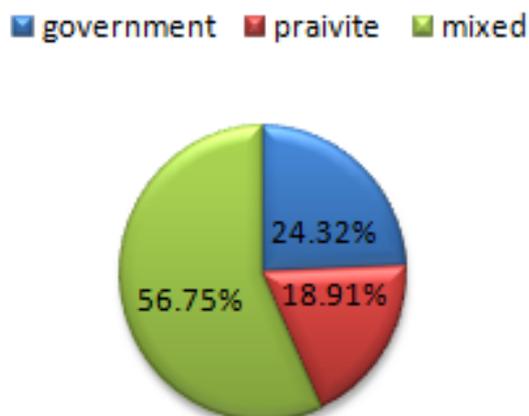


Figure 2: Labor sector.

Figure (3) shows the respondents and their classification according to the years of service. We note that (43.24%) have a service ranging from 5 to 10 years, followed by a service of 10-15 years by (29.72%), and those who have service years 15-20 by (10.81%), and finally the more than 20 and less than five years by (8.10%).

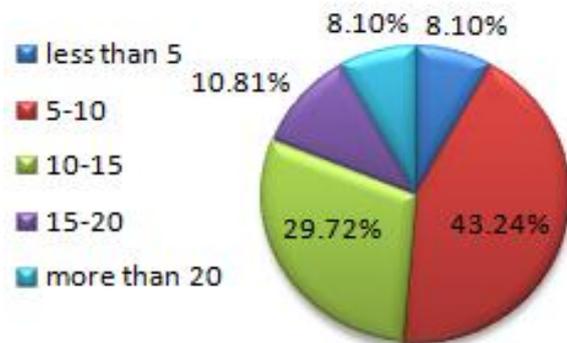


Figure 3: Years of Service

As we note from Fig.4, a description of the respondents' educational attainment, the highest percentage of respondents was bachelor's degree holders (72.97%), master degree (13.51%), higher diploma and master's degree (10.81%), and finally PhD. (2.70%).

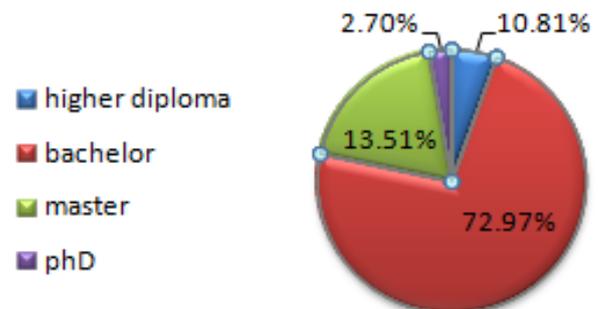


Figure 4: Educational Attainment

4. DISCUSSION AND RESULT

The significance of the questionnaire paragraphs was determined by identifying three levels of importance: high, medium and low, and according to the following equation:

$$\text{Interval Length} = \frac{\text{upper limit of the alternative} - \text{lower limit of the alternative}}{\text{No. of Levels}}$$

The following table shows the scale used to determine the degree of significance for the mean of the questionnaire paragraphs:

Table 1: The degree of Significance

Degree of Significance	The mean
High	1-2.33
Medium	2.34-3.67
Low	3.68-5

The results of the questionnaire were as follows:

Table 2 (in Appendix) shows the descriptive statistics of the first part of the questionnaire (inputs to the cost estimation process). We note from table (2) that the third paragraph of the questionnaire, which states that "Create a detailed document that includes information about accounts, job description,... etc ." take the first rank in terms of its existence or application in the construction project and with an average of (3.783) , and with high significance. While the last paragraph of the questionnaire, which states that "Foundations of the organizational process that may be affect on the costing process and include cost estimation policies, historical information, etc." take the last rank in terms of its existence or application in the construction project and with an average of (1.486), and with low significance, and The fig.5 shows all the paragraphs of the first part of the questionnaire in terms of application or presence in the project.

- The mean: is the average of the numbers: a calculated "central" value of a set of numbers.
- The standard deviation (SD): is a measure that is used to quantify the amount of variation or dispersion of a set of data values.
- Rii :(Relative importance index) :is used to determine respondents' perception of the relative importance of paragraphs

$$= \frac{\sum W}{A * N}$$

Where: *W*: Weight given to each indicator, *a*: Highest weight, *N*: The total number of respondents.

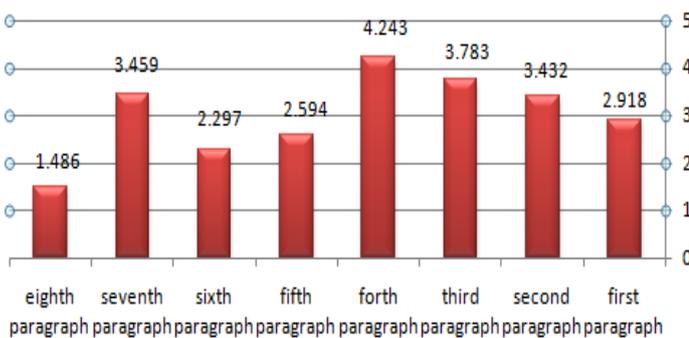


Figure 5: First Part (Inputs to the Cost Estimation Process)

Table 3 (in Appendix) shows the descriptive statistics of the second part of the questionnaire (inputs to the cost estimation process) We note from table (3) that the first paragraph of the questionnaire, which states that "Take advantage of expert opinion In determining the possibility of collecting estimation methods and how to approximate the differences between them" take the first rank in terms of use it in the construction project and with an average of (4.405) , and with high significance. While the fourth paragraph of the questionnaire, which states that " Use bottom-up estimation method where the cost of individual work programs or activities is estimated at the highest level of custom detail" take the last rank in terms of use it in the construction project and with an average of (1.648), and with low significance, and The fig.6 shows all the paragraphs of the second part of the questionnaire in terms of application or presence in the project.

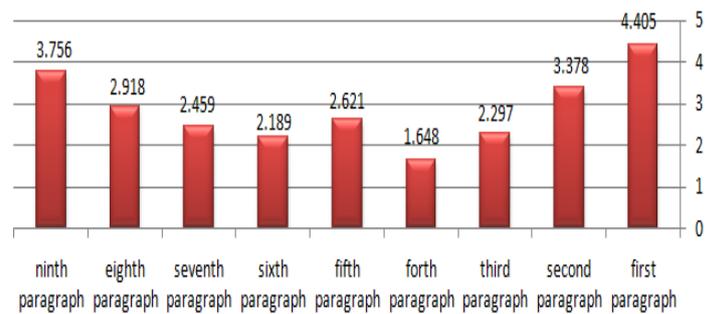


Figure 6: The Descriptive Statistics of the Tools Techniques

Table 4 (in Appendix) shows the descriptive statistics of the third part of the questionnaire (outputs of the cost estimation process) We note from table (4) that the first paragraph of the questionnaire, which states that "make estimates of activity cost(Quantitative assessments required to complete the project , where the cost of the activity is estimated including direct labor, raw materials, equipment, services, information technology, etc" take the first rank in terms of its existence or application in the construction project and with an average of (3.324) , and with high significance. While the third paragraph of the questionnaire, which states that " Updates project documents depending on the risk record" take the last rank in terms its existence or application in the construction project and with an average of (2.108), and with low significance, and The fig.7 shows all the paragraphs of the second part of the questionnaire in terms of application or presence in the project.

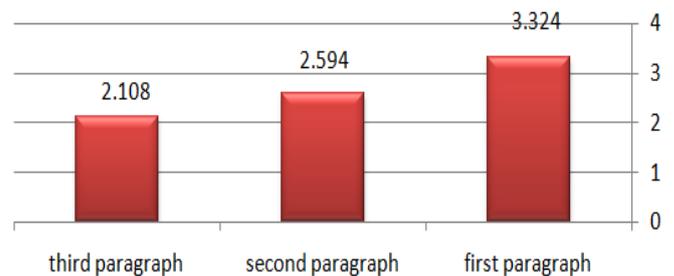


Fig. 7: The Descriptive Statistics of the Outputs

5. CONCLUSIONS

The environment of construction projects is a constantly changing environment, so the construction projects differ between them in terms of the size, type, quality and use of the project. In addition, the similar projects vary between them, depending on location and soil conditions. Or unexpected circumstances may occur, Such as changes in the prices of materials or labor or different working methods, All this leads to a difference in the cost estimate, which may sometimes increase the actual cost of the estimated cost Causing financial loss to the project, so The correct principles of cost estimation must be taken into consideration In order to avoid or reduce this difference After the analysis of the questionnaire found that the most paragraphs applied in the construction projects is the establishment of a document covering all details of the project information and calculations, etc. As for the most commonly used techniques are taking expert opinion in this field, Thus obtaining a cost estimate close to the real cost of the project. While the least paragraphs applied in the construction projects were set the foundations of the organizational process the policies of estimation and historical information, etc. and the least used method is bottom-up estimation method where the cost of individual work programs or activities is estimated at the highest level of custom detail. The results also showed that project documents were not identified based on the risk profile.

6. RECOMMENDATION:

Based on the results obtained from questionnaire, we recommend increasing awareness and understanding of the importance of using all principles and steps of cost management in general and managing the cost estimate in particular in construction projects. so We recommend increasing the use of the paragraphs that the questionnaire has shown to be of poor use, Such as a revision of the risk profile of similar projects, lay the foundations for cost estimation, In addition to ensuring the use of statistical relations between historical data and other variables in the process of estimating the cost, As well as Use bottom-up estimation method where the cost of individual work programs or activities is estimated

at the highest level of custom detail, Include cost estimates on contingency reserves to address cost uncertainty And ensure that Updates project documents depending on the risk record. We also recommend conducting awareness sessions and workshops to clarify the importance and steps of proper cost management of construction projects

REFERENCES

- [1] P. E. G. F. Kam Shadan, Inc, Construction Project Management, 2012.
- [2] P. Newton, "Principles of project management. Project skills," Access at <http://www.Free-management-ebooks.com/dldebk-pdf/fme-project-principles.pdf>, 2015.
- [3] T. Vasista, "strategic cost management for Construction project success: a Systematic study," Civil Engineering and Urban Planning: An International Journal (CiVEJ), vol. 4, 2017.
- [4] A. Guide, "Project management body of knowledge (pmbok® guide)," in Project Management Institute, 2001.
- [5] A. H. Memon, I. A. Rahman, M. R. Abdullah, and A. A. Azis, "Factors affecting construction cost in Mara large construction project: perspective of project management consultant," International Journal of Sustainable Construction Engineering and Technology, vol. 1, pp. 41-54, 2011.
- [6] M. Greenhalf, Project Cost Management, 2014.
- [7] N. H. Ajduković, S. E. Aedif, S. Bezak, and P. C. Eng, "COST ESTIMATE FOR THE CONSTRUCTION OF RESIDENTIAL-COMMERCIAL BUILDINGS."
- [8] K. Chitkara, Construction project management: Tata McGraw-Hill Education, 1998.
- [9] M. K. Othman, Cost Estimation, 2016.
- [10] P. V. Deshpande, "Construction management: preliminary cost estimate and scheduling of MIT's Civil and Environmental Engineering building," Massachusetts Institute of Technology, 1999.

APPENDIX

Table.2: the descriptive statistics of the inputs to the cost estimation process

	The paragraph	Mean	standard deviation	significance degree	Ranking	Rii
1	A detailed description of the project outputs and do the required work to achieve those outputs	2.918	1.583	Medium	7	0.583
2	A sequential analysis of the work to be performed (segmentation into smaller manageable component)	3.432	1.151	Medium	4	0.686
3	Create a detailed document that includes information about accounts, job description ,responsible organization, objectives, activities, necessary resources, cost estimates, quality requirements, admission criteria, technical references and contracting information.	3.783	1.142	High	1	0.756
4	establish the project schedule , estimating the resources of activities and determining the availability of required quantities and labor , also ensuring consistency with the cost estimate	4.243	0.941	High	2	0.848
5	Provide guidance on how to identify, recruit, manage, control and lay off human resources in the project in terms of roles and responsibilities, project planning schemes and project management plan.	2.594	3.340	Medium	5	0.518
6	A review of the risk profile of the same project for the previous stages or for other similar projects, in order to study risk mitigation costs	2.297	1.036	Low	6	0.459
7	Study the factors affecting the project in terms of market conditions and products and services and their presence and methods of supply and knowledge of prices.	3.459	1.285	Medium	3	0.691
8	Foundations of the organizational process that may be affect on the costing process and include cost estimation policies, historical information, etc.	1.486	0.641	Low	8	0.297

Table.3: The Descriptive Statistics of the Tools and Techniques.

	The paragraph	Mean	standard deviation	significance degree	ranking	Rii
1	Take advantage of expert opinion In determining the possibility of collecting estimation methods and how to approximate the differences between them.	4.405	0.787	High	1	0.881
2	The use of the analogous cost estimate is based on the actual cost of previous and similar projects as a basis for estimating the cost of the current project and adjusting it to suit the known differences.	3.378	1.193	Medium	3	0.675
3	Using parametric estimating uses the statistical relationship between the historical data and other variables such as square area to calculate the activity estimate such as cost, budget or period.	2.297	1.087	Low	7	0.459
4	Use bottom-up estimation method where the cost of individual work programs or activities is estimated at the highest level of custom detail.	1.648	0.845	Low	9	0.329
5	The three-dimensional estimation method (BERT method), which uses three estimates of the cost of each activity: the optimistic estimate (cost estimate based on the best case of the activity) The most likely estimate (estimating the cost of the activity based on the realistic effort of the work) and the pessimistic estimate (Estimating the cost of the activity on the basis of the worst case) and merging them together with the Bert equation.	2.621	1.193	Medium	5	0.524
6	Include cost estimates on contingency reserves to address cost uncertainty.	2.189	1.210	Low	8	0.437
7	Calculation of the cost of the quality, which includes all the costs, required to comply with the requirements and divided into the costs to prevent failure (or non-conformity) or the costs spent during and after the project to remedy the failure situation.	2.459	1.040	Medium	6	0.491
8	Estimating project management using computer programs, simulation and statistical tools.	2.918	0.611	Medium	4	0.583
9	Cost estimation methods include the cost analysis necessary for the project based on the positive offers made by qualified vendors in competitive processes.	3.756	1.024	high	2	0.751

Table.4: The Descriptive Statistics of the Outputs of the Cost Estimation Process.

	The paragraph	mean	standard deviation	significance degree	ranking	Rii
1	make estimates of activity cost(Quantitative assessments required to complete the project , where the cost of the activity is estimated including direct labor, raw materials, equipment, services, information technology, etc.	3.324	1.336	Medium	1	0.664
2	The documents should provide a clear and complete understanding of the manner in which the cost estimate was derived Which should include the following details: Documentation of the basis of estimation and all assumptions, any possible constraints in addition to the scope of the estimates and indicating the level of confidence in the estimates.	2.594	1.101	Medium	2	0.518
3	Updates project documents depending on the risk record.	2.108	1.085	Low	3	0.421