

## An overview of planning management processes and project cost control according to the PMBOK standard

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### Abstract

Nowadays, there are global standards by which productivity can be achieved, and they bring success for the projects. This aim is feasible by project management science. The project managers also seek to manage the project costs appropriately, and they need a thorough standard to control the costs. Besides, most of the project managers tend to use the PMBOK<sup>3</sup> standard. This standard has the processes based on planning, estimation, budgeting, financing, funding, management, and cost control, and they lead to executing the project according to the approved budget framework. The final calculated cost to implement a project is considered a striking problem that managers try to deal with. Therefore, it is evident that the financial planning and management of the problems result in a cost increase needing considerable attention. The present research sheds new light on the PMBOK standard and explains the processes associated with project cost management according to this standard. It would also be of particular interest to project managers to make an appropriate decision to control the costs.

**Keywords:** planning, estimation, budgeting, financing, funding, costs control

### 1. Introduction

In the project management system, it is of great importance to have a successful project at the end. Hence, this system must be defined appropriately to have an optimal result. At this point, the manager has a responsibility to control the cost of the construction period. Moreover, the success depends on having the project completed on time while the costs do not exceed the expected limit. Nevertheless, when the project was not completed at the proper time, and the costs were more than the expected limit, the project's aims would be unlikely to be achieved, and the employers would not obtain the desired results. Cost management is based on a conception that says the costs are not created by themselves. The manager's decisions generate all costs, mainly focused on using the organization's limited resources. The cost management approach is considered a vital factor to make managers decide based on valuing the stakeholders. It seeks to create an appropriate and creative combination between distinct stakeholder resources. Actually, there are a number of instructions and techniques to analyze management decisions and support them individually, while the philosophy and view of cost management are based on these tools. Broadly speaking, the financial budget is not enough for the construction projects, and a manager's target is to have the highest profitability with the least budget. It is essential to estimate the project precisely to achieve this purpose, and the projects must be controlled to complete on time. Consequently, the costs will be based on the first estimation. Since the employers are responsible for the project costs, the employer and contractor seek to control the costs and make sure the expected profit is achieved. Hence, cost control is considered an integral aspect of construction management (Maral. Monadi, 2008).

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<sup>3</sup>- Project Management Body of Knowledge

# یازدهمین کنگره ملی سراسری فناوریهای نوین در حوزه توسعه پایدار ایران

11<sup>th</sup> National Congress of  
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Project cost management basically depends on the cost of resources that are necessary to conduct project activities. However, the effect of decisions on the cost of employing the project product must be taken into consideration. For instance, limiting the number of design inspections is in direct proportion to the project costs decline, but rises the operational customer costs. This novel idea regarding the project cost management is mainly called costing the circle of life, which is utilized with value engineering techniques to minimize the cost and time, make better the quality and performance and optimize decision making (Smith et al. 2003).

According to Figure 1, the processes related to the project cost management and based on the PMBOK standard consist of cost management planning, cost estimation, budgeting, and cost control. These processes are represented as discrete processes with the defined interface. While practically, there is a non-defined overlap and interaction between them, which is based on the PMBOK guide's principles. There is an interaction between these processes, and they also interact with the processes involved in another science domain.

In particular, there is a close relationship between the cost estimation and budgeting in the projects with a smaller scope. In other words, they are one process operated by an individual in a short time. These processes are considered two distinct processes, and they are as different as their tools and techniques. In the initial steps, there is an ability to affect costs, which is more considerable compared to the steps defining the initial scope of the project vital. (PMBOK,6 edition)

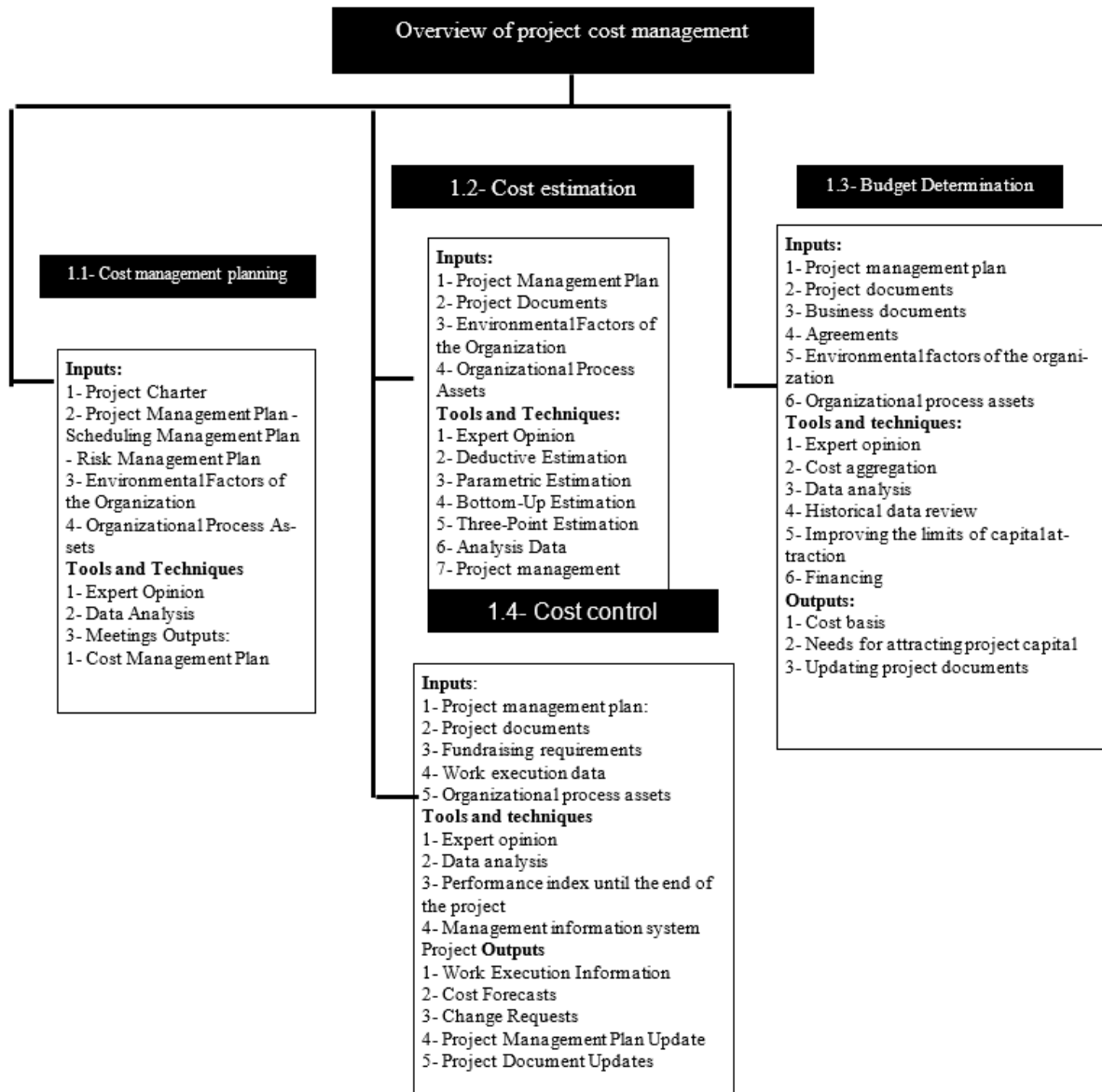


Figure 1. Overview of project cost management (PMBOK, 6 edition)

## 2. Theoretical Foundations

### 2.1. Some definitions related to project cost management

- The purpose of cost management is to determine the format and criteria for planning, organizing, cost estimation, budgeting, and project costs control. When cost management and time management are integrated, they will be more effective and become one of the most critical parts of the project management plan. (Zakai Ashtiani, 2013)

- Cost management includes decisions concerning the project cost planning approach. Hence, its macro strategy should be considered at the beginning of the project (Robert Purifoy, 2002).

In other words, cost management means the optimal and efficient use of organization resources to create value for customers. Actually, it means the profitability and growth of the firm are achieved by valuing

the customers. Cost management is the philosophy of improvement; Because it seeks the appropriate ways to make decisions that include valuing the customers and cost reduction. In fact, cost management consists of tools and techniques that can be used thoroughly to analyze management decisions and support them individually (Mir Mohammadi. Samaneh, 2013).

## 2.2. Costs management planning

Cost management planning is a process that describes how to estimate the costs, budget, manage, monitor, and control them. The key advantage of this process is its capability to specify the path and instructions for managing the project costs. This process is either conducted once or at the points that are already defined. Figure 2 highlights the inputs, tools, techniques, and outputs of this process, and the flowchart of that is outlined in Figure 3. (PMBOK,6 edition)

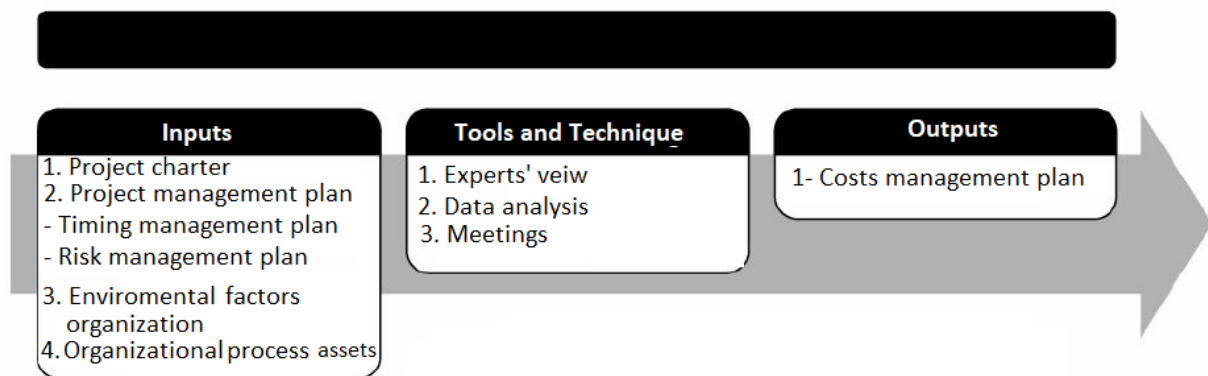


Figure 2. Cost management planning: inputs, tools, and techniques and outputs (PMBOK, 6 edition)

At the beginning of the project planning, efforts are made to plan costs management and specify the frameworks for the cost management processes individually. This processes performs effectually in harmony. Cost management planning has documented the cost management processes, tools, and related techniques, and this type of plan is part of the project management. (PMBOK,6 edition)

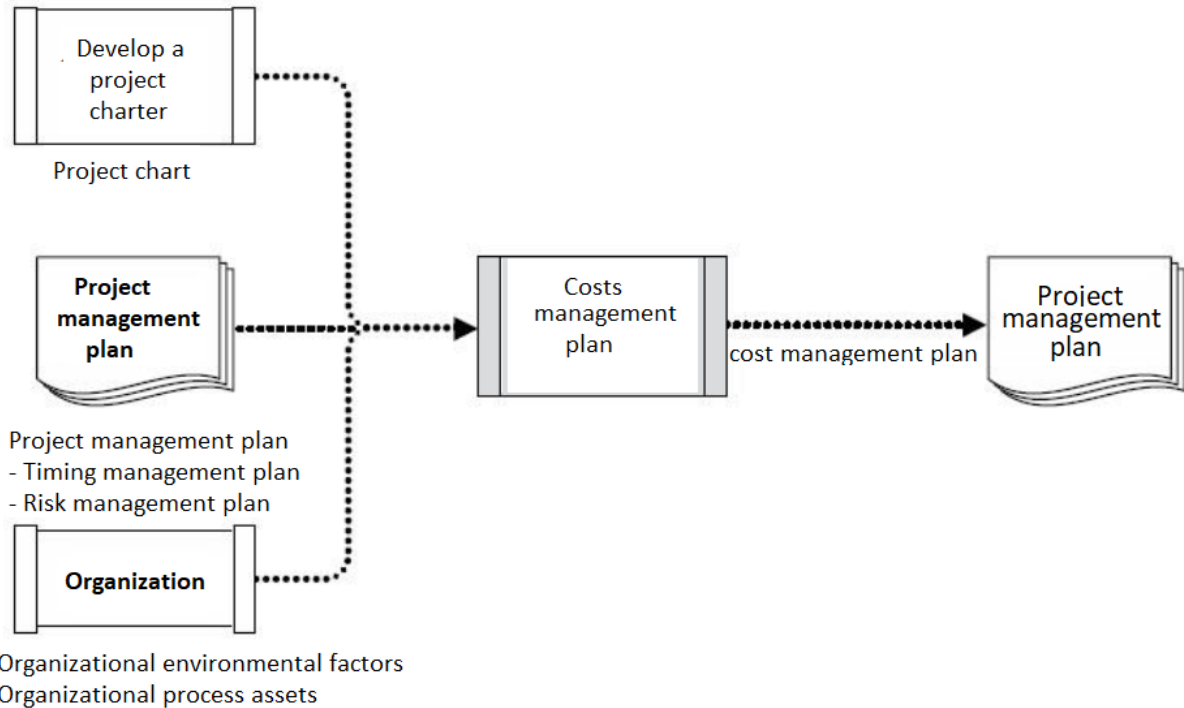


Figure 3. Costs management planning: The Data Flow Diagram (PMBOK, 6 edition)

### 2.3. Problems for planning project costs in times of inflation

Projects need to set their activities based on long-term planning, as illustrated in the chart below. As a result, the aims will be achieved based on the classification type because the plans are the means to attain targets. For instance, a project with a predetermined target can attain targets when it has conducted all the necessary analysis beforehand to estimate its costs and revenues during its useful life. In this regard, long-term planning must be considered, and then the long-term plans must change into two to three medium-term plans individually. Similarly, each medium-term plan also changes into three to five short-term plans, and implementation begins from the short-term plans. Clearly, estimating these factors is not easy, even in a perfectly normal economic situation. When there is severe inflation for the prices of various goods, services, and materials, the rate of salaries and wages and the banking system's interest rate is continually changing and needs a superior accurate and logical estimation. The condition is much more difficult for decision-makers and project financial management (Sheikh Abu Masoudi, Abbas, 2018).

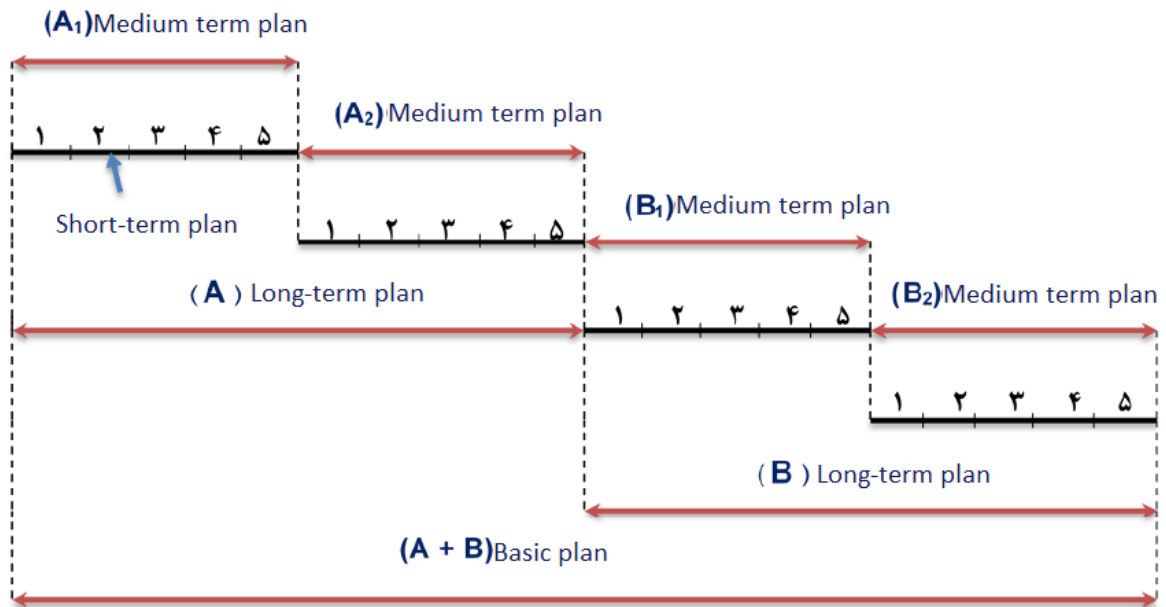


Figure 4. classification of project costs plans in terms of time (based on the classification of the target), Sheikh Abu Masoudi, Abbas, 2018

## 2.4. Costs estimation

Cost estimation is the process in which the cost of resources required to conduct a project is approximated. The striking advantage of this process is its ability to specify the financial resources needed for the project. If necessary, this process is conducted periodically within the project. Figure 4 highlights the inputs, tools, techniques, and outputs of this process. The data flow diagram of the process data is represented in Figure 5. (PMBOK,6 edition)

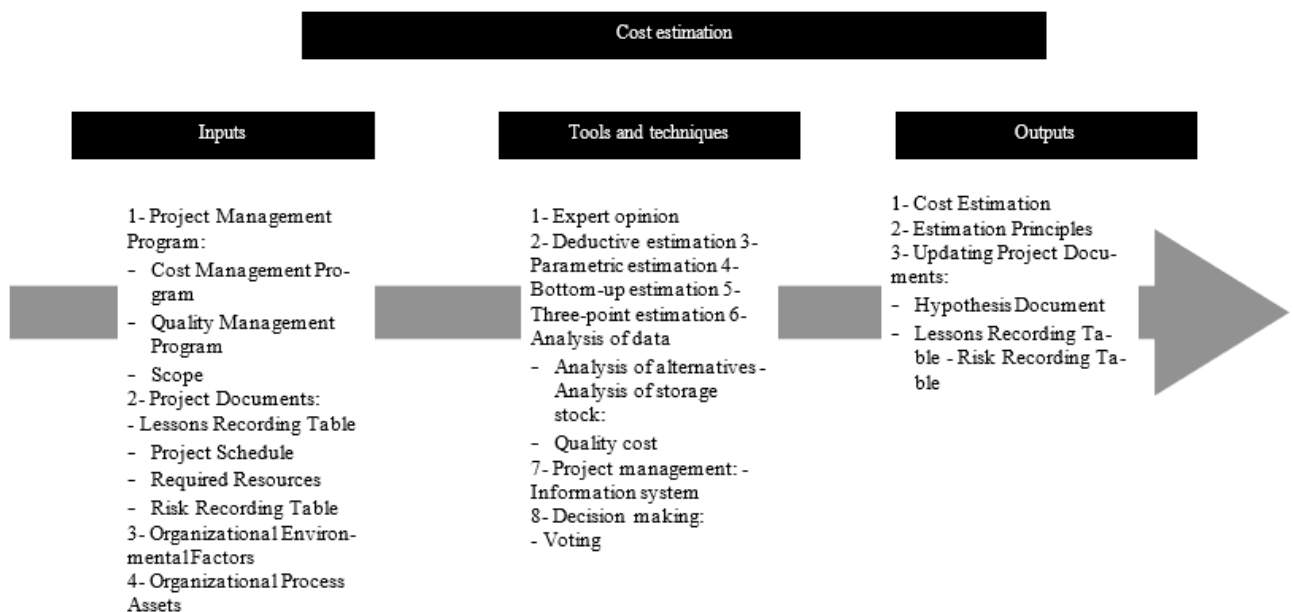




Figure 5. Cost estimation: inputs, tools, techniques, and outputs (PMBOK, 6 edition)

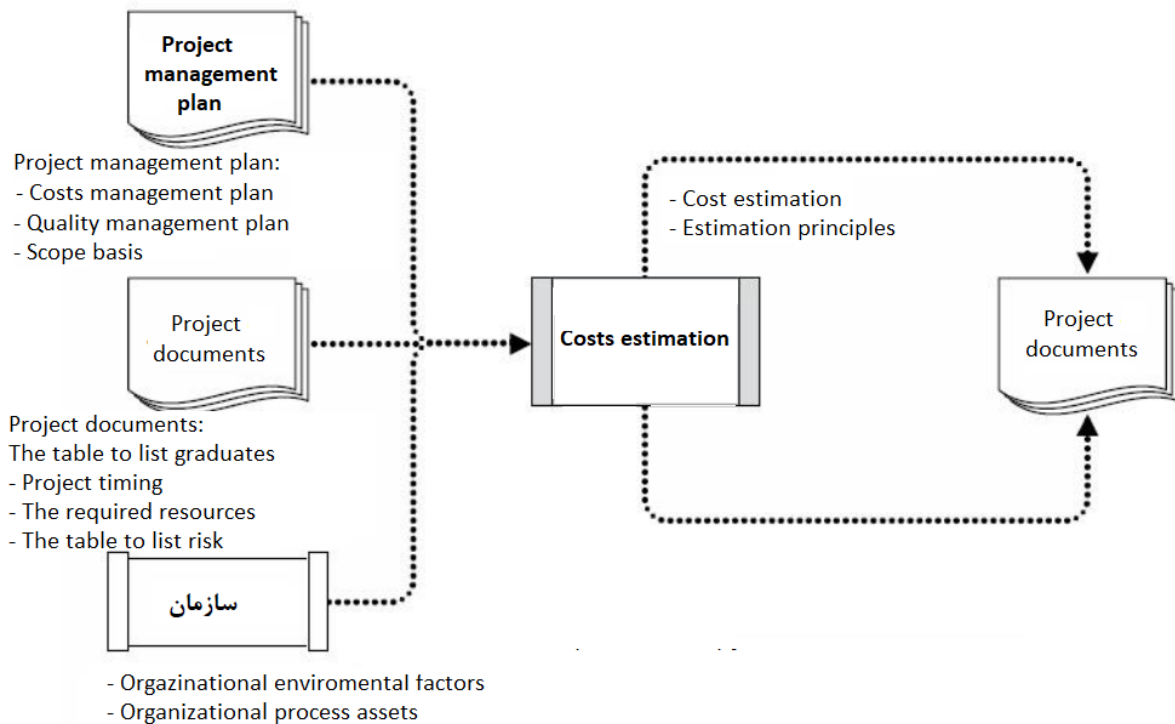


Figure 6. Costs estimation: The Data Flow Diagram (PMBOK, 6 edition)

Cost estimation means assessing the potential costs of the resources necessary to conduct an activity. This evaluation is done quantitatively, and it is considered a prediction depending on the characteristic information at a particular time. Moreover, this type of estimation includes identifying and examining alternative options for costing, starting, and completing a project. Risks and cost trade-offs, such as construction and purchase, purchase and leasing, and resource sharing, should be investigated to obtain the project's optimal costs.

Cost estimation must be inspected and improved pending the project. Hence when the new details are available, the detail must be taken into consideration, and the assumptions will be tested. As the project progresses through the project life cycle, the accuracy of the project estimation increases. For instance, the project costs estimation in the first step might be executed by the rule of thumb at macro level 2 (ROM) <sup>4</sup> in the range between -25% to + 75%. With access to more information, definitive estimations can increase the accuracy range by - 5% to +10% in the next steps of the project. There are some instructions for when these corrections are possible in some organizations, and there is an amount of confidence or expected accuracy.

The costs of all the resources needed to conduct the project are estimated. These costs include, but are not restricted to: labor, materials, equipment, services, facilities, and specific categories such as the amount of inflation allowance, the cost of financing, or contingency costs. Costs estimation is either provided at the activity level or in brief form. (PMBOK,6 edition)

<sup>4</sup> Rough Order of Magnitude

## 2.5 The budget determination

There is a process that means budgeting; in this process, single work packages or the estimated costs of activities are aggregated together and determine the allowable cost base. The significant advantage of this process is that it specifies a basis to control and monitor the project performance. This process is either conducted once or at the points that are already defined. Figure 6 outlines the inputs, tools, techniques, and outputs of this process, and Figure 7 represents the data flow diagram of this process. The project budget includes all the financial resources allowed for the project. The costs basis means the approved version of the time-phased budget, including contingency reserves, but does not include managerial reserves. (PMBOK,6 edition)

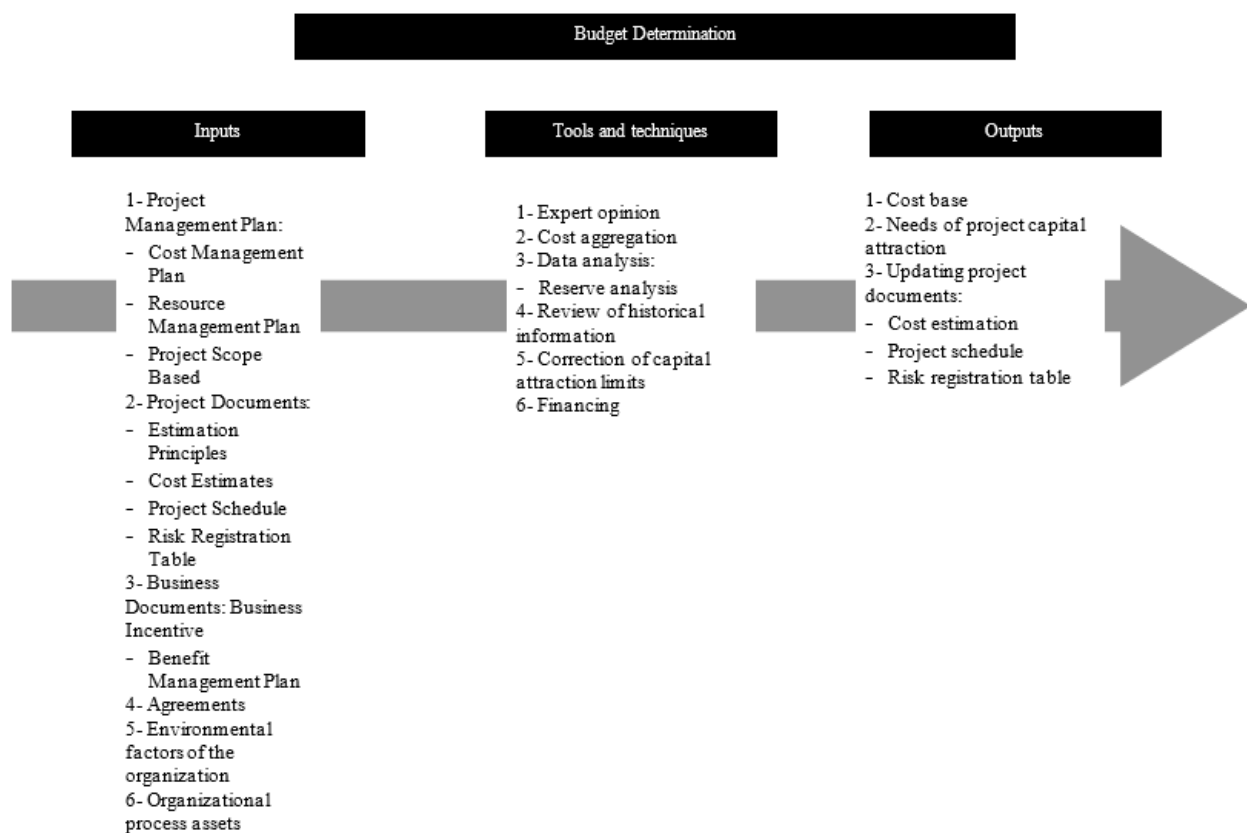


Figure 7- Determining the budget: inputs, tools, techniques, and outputs (PMBOK, 6 edition)



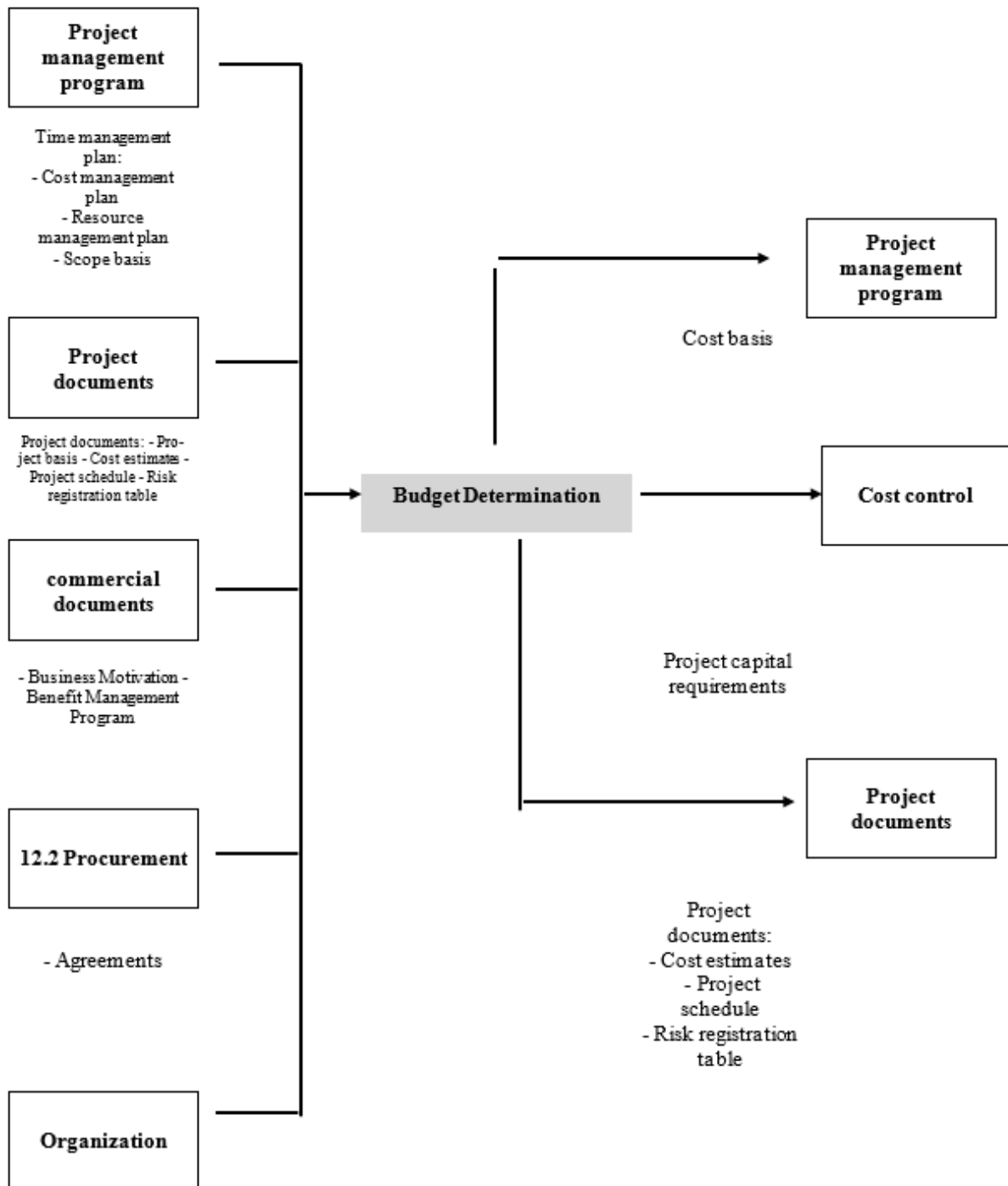


Figure 8- Budget determination: Data flow diagram (PMBOK, 6 edition)

## 2.6 The costs control

Cost control is how the project state is monitored to manage project costs for updates and changes in the cost base. This process's key advantage is its ability to maintain the cost basis while the process is being conducted within the project. Figure 10 demonstrates the inputs, tools, techniques, and outputs related to the process, and Figure 11 outlines its data flow diagram.

Budget updating needs awareness about the actual costs that have been incurred to date. Any rise in the allowable budget requires approval by the integrated change control process. Cost supervision regardless of the amount of work done in return for these costs is of little value to the project, except that the outflow of financial resources is detected. Most of the actions taken to control costs include the relationship analysis between the project's financial resources' consumption and the work done in return for these costs. In fact, a key point for effectual cost control is the primary management of the approved cost. (PMBOK,6 edition)

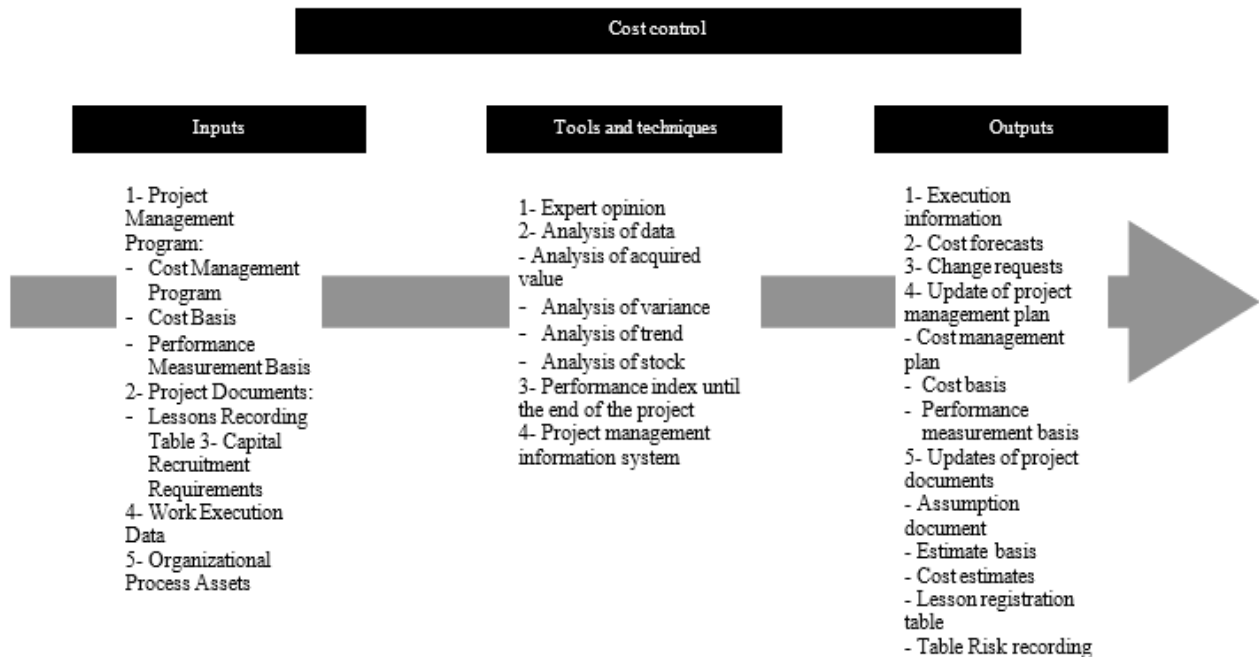


Figure 9. Cost control: inputs, tools and techniques and outputs (PMBOK, 6 edition)

Controlling the project costs includes the following items:

- Influence on factors that cause changes in the basis of allowable cost.
- Ensure that all demands for change are satisfied on time.
- Managing real changes at the time they occur.
- Ensure that each period's expenditures, each WBS component and activity, and in all projects do not exceed the allowable financial resources.
- Cost performance is monitored to separate and understand variances based on approved costs.
- The implementation of work is monitored based on financial resources.
- Prevent the unapproved changes from being considered in reported cost or resource consumption.

- Inform the relevant stakeholders of all approved changes and related costs.
- Return the expected additional costs to an acceptable level (PMBOK,6 edition)

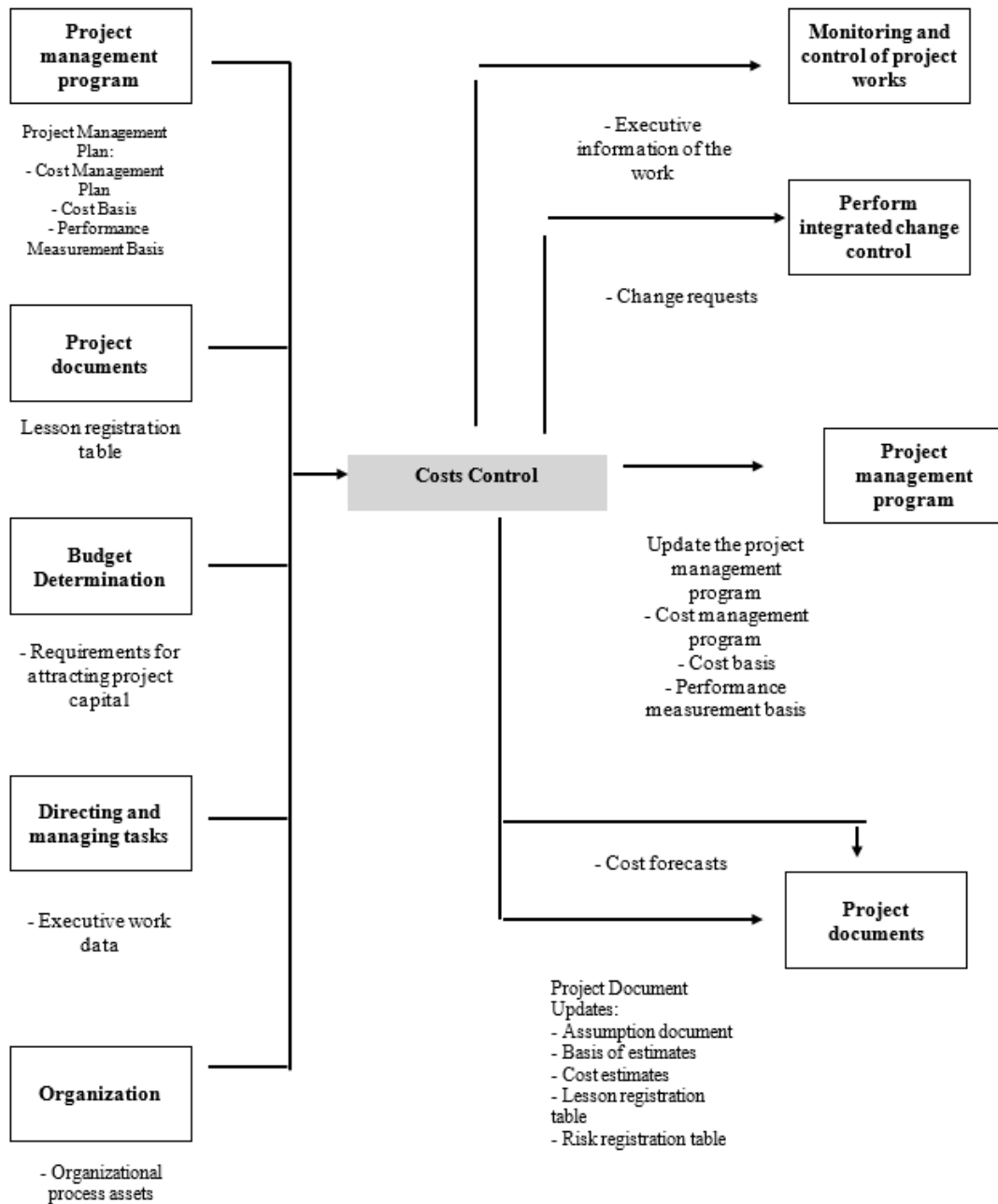


Figure 10. Costs control: The data flow diagram (PMBOK, 6 edition)

### 3. The role of financial management in projects

Financial management plays a prominent role in achieving its goals, policies, and financial success. The most important task of these roles are:

- Project financial analysis and planning.
- Making decision capitals in the project.
- Provision of the necessary financial resources and decisions related to the project's financial structure (financial resource management).
- Financial decisions – Working capital management of the project.
- Financial decisions – Balance between risk and efficiency.
- Financial Decisions – International Financial Management: Rapid advances in technology, global information networks, information systems, and information technology have brought countries closer together. This problem requires attention to international financial affairs in the projects and schemes of micro-level and macro-level (National level)
- Financial decisions - Inflation: Inflation, and especially double-digit inflation, is one of the most complex and critical problems that continually change the prices of goods and services, wages and interest rates, and consequently, project decisions and plans. Project financial management must provide the schemes to neutralize adverse conditions and continue the project's life based on the conditions.

One of the most critical roles that can be effective in optimizing project costs is how to manage the financial resources of the project, which is summarized below (Sheikh Abu Masoudi, Abbas, 2018)

#### 4. Investment (budgeting) – Capital allocation

Due to the limited budget or capital as one of the integral factors of carrying out any project's activities, the problem of optimal allocation of capital to projects in each period is of great importance. Therefore, this capital can be optimized through the linear programming technique, as illustrated in the example below:

Example: An institution wants to invest 1,000,000 units of its capital in three different projects. The table below gives brief information needed to invest in each project. The institute seeks optimal investment in these three projects to achieve maximum liquidity at the end of 5 years. Investment is not allowed when the return is achieved after five years.

**Table (1): Information**

Project	The maximum amount of investment allowed	Return on capital (percent)	Return time (year)	Possibility of reinvestment
1	400	14	One year	Available
2	Unlimited	11	Two years	Available
3	200	15	Three years	Available

The problem can be formulated through the linear programming model, and the optimal solutions can be found by solving it with QSB software.

$X_{ij}$ = Investment amount of  $i$ th project in  $j$ th year, ( $i$ = Project= 1,2,3) and ( $j$ = Year= 1,2,3,4,5)

$S_i$ = The remaining capital at the end of the  $j$ th year.

Max  $Z=1.14X_{15}+1.11X_{24}+1.15X_{33}+S_5$

S.T.:

$X_{11} + X_{21} + X_{31} + S_1 = 1000000$  Year Limitation (1)

$X_{12} + X_{22} + X_{32} + S_2 = S_1 + 1.14X_{11}$  Year Limitation (2)

$$X_{13} + X_{23} + X_{33} + S_3 = S_2 + 1.14 X_{12} + 1.11 X_{21} \text{ Year Limitation (3)}$$

$$X_{14} + X_{24} + S_4 = S_3 + 1.14 X_{13} + 1.11 X_{22} + 1.15 X_{31} \text{ Year Limitation (4)}$$

$$X_{15} + S_5 = S_4 + 1.14 X_{14} + 1.11 X_{23} + 1.15 X_{32} \text{ Year Limitation (5)}$$

$$X_{ij} \leq 4000, i=1, j=1,2,3,4,5$$

$$X_{ij} \leq 2000, i=3, j=1,2,3$$

$$X_{ij} \geq 0, i=1,2,3, j=1,2,3,4,5$$

### 5. Emerging trends and methods in project costs management

In the practical field of project costs management, the trend is that earned value management (EVM) is developed and includes the concept of earned schedule (E.S.). In fact, earned schedule (E.S.) means developing the theory and earned value management (EVM). The theory of earned schedule replaces the earned schedule (E.S.) and actual time (AT) with the criteria of variance schedule used in traditional earned value management (Earned value – Planned value). According to the alternative equation for calculating the schedule variance, if the earned scheduling value were more than 0, the project would be considered ahead of schedule (ahead of plan). In fact, the project's achievements are greater than the amount planned at a specific time. Using the earned schedule scales, ES\_AT is the schedule performance index (SPI). This index represents the efficiency of work (SPI). Also, the earned schedule theory employs the earned schedule, actual time and the estimated schedule, to provide the formulas for predicting the time of project completion.

### 6. Conclusion

Planning is the key to success in managing a project based on its various levels, and it is crucial to control the costs of the various steps of the project. However, it is a successful program that depends on the strengths, weaknesses, opportunities, and threats (SWOT).

This process is conducted by the analysis tools and based on information contained in the primary financial accounts and financial reports, which are as follows: Financial scales tools, horizontal and vertical analysis, break-even points analysis, etc.

Therefore, forming a project is the same as budgeting, which is initially based on the project's long-term aims (strategic aims) called strategic budget (financial plan). This framework is divided into two or three medium-term budgets. Each medium-term budget is converted into three to five short-term budgets, and the cost control is conducted accordingly.

In other words, it is used to identify and determine the most efficient system for allocating project resources and demonstrate the control mechanisms for planning budgets and budget process. The optimal use of limited resources to achieve project aims requires planning. Since the various activities and operations of a project are reflected in the form of financial information, the conversion of programs into the language of money is called budgeting.

Budgeting is used as a management tool to plan and control the project's various operations to achieve its aims and specify how many capital resources (budget) are required? How this amount of capital is provided (what are the different methods of financing)? In what fields and to what extent each of them should be consumed? How should the expenses be controlled? Furthermore, considering the expectation to make a profit, how much will it randomly be?

According to the concept above, it can be concluded that: project budget is a work plan, a prediction, and economically affordable license, a criterion for determining the type of cost and amount of financial resources of each of them and measurement for measuring efficiency and effectiveness of projects.

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