

# Research on Innovation and Cost Management Based on Project Integrated Management Theory

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**Abstract:** The main work of this paper aims at the existing defects of the theory and practice of domestic engineering project cost management and its deficiencies, and based on a correct understanding of the project cost concept, sets up the theoretical system of project cost management science and project operation cost management method. This paper analyzes the project organization mode of the engineering industry's current situation, lack of integrated management mode and the ways of implementing the management ideas and computer integrated manufacturing management methods, which are applied to engineering project management. It further puts forward the concept of an integrated management model integrating the three parts of engineering project management thought, constructed by the project life cycle management factors.

**Keywords:** Collaborative commerce, Incentive model, Integrated management, Management elements.

## 1. INTRODUCTION

Project management is a very important part of the whole management field. Compared with the general project management, enterprise management has its own characteristics [1]. The general target of enterprise management is all kinds of enterprises in the relatively controlled and repeated process of production and business activities. However, the target of project management is usually a one-time occurrence of projects and project implementation in a variety of process activities [2-4]. The project is not repeated, environmental conditions of uncertainty, the project activity, the complexity of the whole project life cycle, risk factors and other characteristics, make the project management more and more challenging. Especially in recent years with the rise and development of software engineering, construction engineering and other engineering fields, research on construction project management has attracted more and more attention, and hence project management is becoming one of the important research fields [5].

Project cost management is a very important aspect of project management. Project cost management will have a direct impact on the overall project management level and results. Project management practice requires the guidance of scientific methods of project cost management. Because project cost management covers many different aspects of enterprise management such as financial and cost accounting, and general management, therefore, general financial management, accounting methods and cost control methods can not be applied directly to the project cost management. Thus, in some developed countries, people investigate

the characteristics of the project management theory and research methods specifically for project cost management [6, 7].

According to the general definition of the project, a project is just a series of tasks undertaken by a team [8]. The end result of the project may be a facility, such as automobile manufacturing, roads, power plants. It can be said to be a fixed asset, so the result is an investment. It is easy to think that the project is a phenomenon of investment. However, because project task is only part of the investment process, so the project can not be equated with the investment of the whole process [9]. Investment process can be used as an investment project to manage the use of project resources. Project management should have a content of project cost management, but should not be under the conditions of investment management concepts such as control. If investment project management methods are not used, they may be identified in the process of the investment management, management control and the like, which is not a problem. However, the same can not be happened in the case of project management [10, 11].

In view of the selection of theoretical problems in the project cost management, this paper tries to explain why and how the project cost management must have a theoretical basis from project management point of view, in order to study the science of project cost management system. This paper introduces the concept of internal integration projects, and noted that integration and lifecycle management elements are integrated within the thinking which is reflected in the time dimension and elements of project management, integrated for the entire life cycle. This paper discusses the characteristics of the basic model and integrated management elements for implementation. Given the elements of an integrated model of project management, life cycle of a project has been divided into different processes which respect

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tively fall into following five phases: starting stage of the process, the planning process, the implementation process, phase control process, and the end stage of the process. This paper discusses the project integrated management in the form of analysis of an organization network to highlight the virtual organization's project management's superiority over the integrated management.

**2. RELATED THEORY**

**2.1. The Research Status**

Knowledge of the project cost management gradually established and deepened and productivity in the management of scientific theory increased with the advancement of time [12]. Home construction cost management from the initial project cost control, has been developed into a large infrastructure project cost management such as the Three Gorges Dam Project. For such a project cost management, people have experienced years of continuous learning, and constantly summed up their experiences, continuous exploration and innovation process. And today, people are still doing tireless efforts for the continuation of this process, so that the theory project cost management and its methods can continue to progress and develop, in order to meet the growing needs of human society [13, 14].

From the 1970s to the 1980s, countries have launched their own cost engineer qualification certification work, which requires that the cost engineer or quantity surveyor must complete professional courses and training for basic education and experience requirements. These played an important role in promoting and development of discipline of project cost management [15].

**2.2. The Research Object and Hypothesis**

Project implies requesting the parties to produce the desired results and assume an effort. You may either chose to design a project, or just do construction, or it can be a combination of both. The project is not just the design, or construction, or just a combination of both, because the project management method has been designed not only for both projects, but is also applicable for the design and construction of the project of the project portfolio.

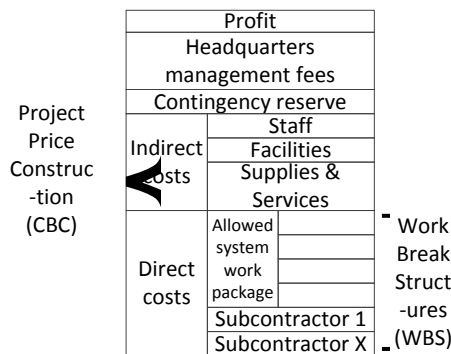


Fig. (1). Unforeseen expenses and profit composition.

The contract price of the project by the contractor such as direct costs, indirect costs, unforeseen expenses and profit composition, are shown in Fig. (1). According to the theoretical definition, the direct costs, indirect costs, unforeseen

expenses belong to the project cost. In the text, if not specifically stated, the direct costs are the actual project cost. Only this definition is able to meet the conditions of project cost management. Project cost management is an integral part of project management in order to control costs provided in the budget cost estimates undertaken to develop cost estimates and cost control management.

**2.3. Related Theory of Cost Estimation**

Expression of total cost: using the basic cumulative average cost function, the total cost of production of X units is calculated as follows:

$$y_{TC} = ax^{(1-b)} \tag{1}$$

Expression of unit costs: calculating the unit cost of production of the X units by product type:

$$y_{UC} = ax^{(1-b)} - a(x-1)^{(1-b)} \tag{2}$$

Expression of marginal cost: the calculation of the marginal cost of production of the X units by product type:

$$y_{MC} = d(y_{TC}) / dx = (1-b)(ax^{-b}) \tag{3}$$

The total cost (TC) function of the growth rate can be defined as the incremental unit cost for a certain period of time, then the unit cost function becomes:

$$y_U(x) = d(TC) / d(x) = (1-b)(a)(x^{-b}) \tag{4}$$

For most calculations and regression analysis, the units of intermediate model requirements were used to determine the middle unit, usually for a production batch computing intermediate units, in order to be able to obtain the estimated average cost. Unit cost substantially the average cost of a batch is determined for the batch of intermediate units, so the estimated average cost of a previous batch only need from a middle unit to obtain another intermediate unit's estimated unit cost. In a given batch, if X2 is a batch at the end of the volume, X1 is a batch at the beginning of the volume, then batch total cost (using the cumulative cost calculation formula) and unit cost will be obtained as follows:

$$y_{TC} = (a)(x_2^{1-b}) - (a)(x_1^{1-b}) \tag{5}$$

$$y_{UC} = (1-b)(a)(x^{-b}) \tag{6}$$

**3. FRAMEWORK CONSTRUCTION OF COST MANAGEMENT SYSTEM**

**3.1. Estimation Techniques**

According to the project development stages, a project needs accurate time and cost estimates. From the initial estimates to entering the construction phase of each design stage, Fig. (2) shows the characteristics of estimate that run through the whole process of project. Preliminary estimates initially form the basis for all later estimations and comparisons. The later estimates are generally consistent with the initial estimate of expectations (which is equal to or less than). However, many a times the final project cost is more than the initial estimate.

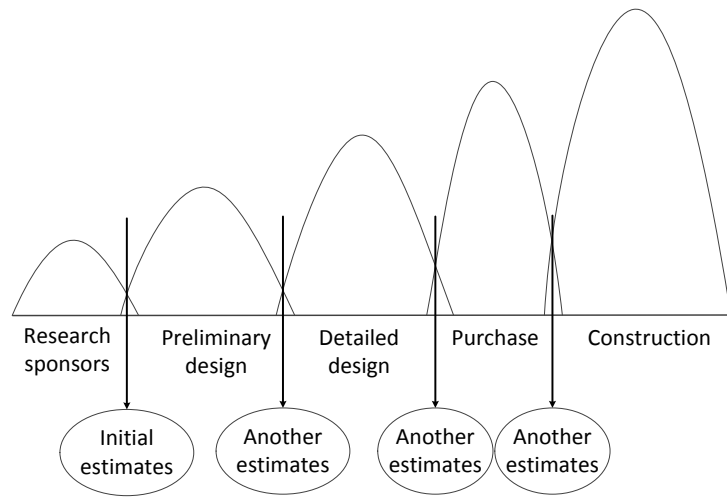


Fig. (2). The characteristics of estimate that runs through the whole process of project.

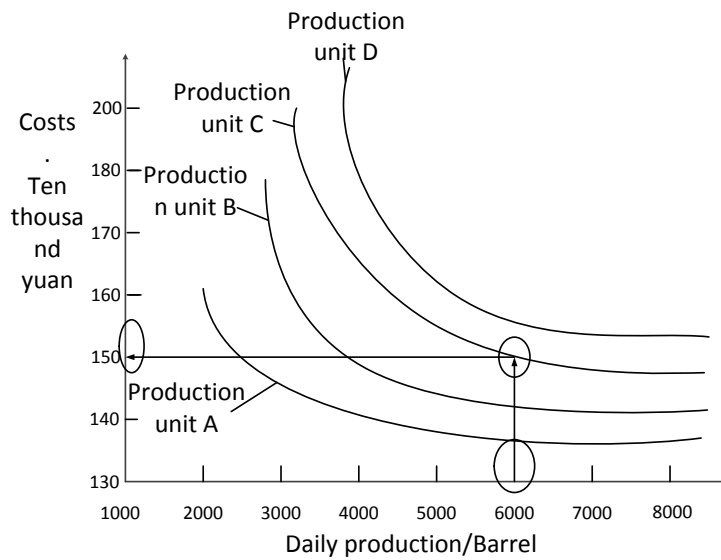


Fig. (3). The cost yield curve of some production unit of a chemical plant.

For a construction project cost estimation, early accurate estimate is very important for the owner and the design team. For the owner, early cost estimates are often used in the implementation of enterprise assets expansion strategy, basic screening potential projects, the preservation of resources for future project development and decision making. Inaccurate early estimation will lead to the loss of opportunity, waste, reduce the development effort and expected return.

Because the early estimation is one of the key project parameters, so it is important for the project team. It helps in the implementation strategy, and provides the basis for the design and construction plans. In a project from the design development to the construction, early estimation is often cited as a reference to recognize the change. In addition, performance of the project team and the entire project's results are usually judged by comparing with the early cost and final cost estimation.

**3.2. Cost Budget**

The yield curve. These curves are used to formulate the cost data estimation of the completed work for feedback and

update. This information has been standardized for a certain place, and as of a specific range of time, such as in a particular year December is presented as a benchmark.

Cost estimation: To estimate the cost, first find yield position at the level of X axis, and then make a linear curve supported by the obtained intersection, and then make a horizontal straight line intersecting the Y axis. The curve that gives the total construction cost, can be adjusted to now or at some point in the future, and can be further adjusted to reflect other geographical position.

For example, Fig. (3) shows the cost of some production unit of a chemical plant obtained through the yield curve.

**3.3. Cost Management System**

Fig. (4) illustrates that a complete project integrated management system of a project's life cycle constituting three parts integrated elements of integration and external.

The whole project life cycle and phases of integration refer to the engineering project integrated management that will be implemented for the entire cycle from design to con-

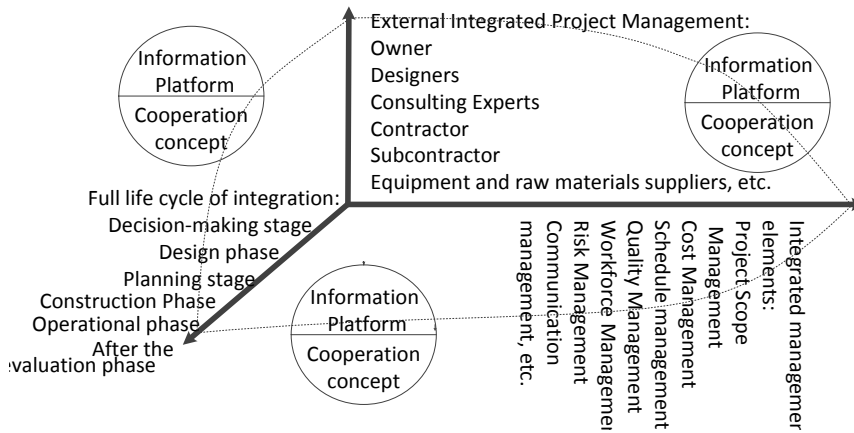


Fig. (4). The project integration management of project life cycle integrated by three parts integrated elements.

struction operation plan decision after the last evaluation through the exchange of information between each link and stage, and fully is integrated as a whole so that the information can be accurately and fully transferred to each participating stage and an effective communication can be carried out and cooperation achieved in various stages of the project.

A project has objectives such as timeframe, quality, cost, range, human resource, risk, communication, influence and restricting the management. The project integrated management is the process of implementation of these project objectives and elements following an overall planning and consideration, in order to achieve the optimization of the overall project. It can be seen that between the two elements of the whole integrated project, i.e. its life cycle integration and management integration, the former is based on the time dimension, whereas the latter is based on the management dimension.

**3.4. Estimation of the Basic Premise**

Project scope definition degree is one of the key problems that must be solved as soon as possible, because the estimation accuracy depends on the definition of project scope. The user must provide accurate and detailed estimation to a desired degree. To estimate, the team must be with the user in making the estimates who will clearly communicate them, users must also be provided with specified requirements of the estimate, and the team should be submitted the content that will provide basis for the decisions made. The key problems of the early estimation is shown in Table 1.

**Table 1. Early estimates compiled key issues.**

<ol style="list-style-type: none"> <li>1. How to define the scope of the project in detail?</li> <li>2. What users want and the level of detail in precise meaning?</li> <li>3. What is the content of this effort by submitting a request?</li> <li>4. What is the basis of this estimate to make decisions?</li> </ol>
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Estimation of the user and the team held a startup that will provide the estimating team a user-related information exchange to meet these project expectations. After the start meeting progress according to the schedule, regular meetings will ensure continuous correction of the estimation process.

To help find out the problems to be solved and put them into files, project management should launch an open communication between the user and the team. The user's early intervention reduces the possibility of conflict raised due to the team issued instructions and guidance. Directional issues need collaborative efforts between a team and users.

Although the range of the definition of good estimation is important, but the project team's ability and experience as well as the estimation procedure also play important roles. Fig. (5) shows an early project scope definition with a low degree of importance given to the team participation allowed project estimation. Business units must rely on early accurate estimation based on the team's experience and ability, because in the early project scope definition, the degree is low and often poorly defined. Quantity surveyor has to rely on the limited scope definition and has been engaged with the user communicating the scope definition degree for budgeting.

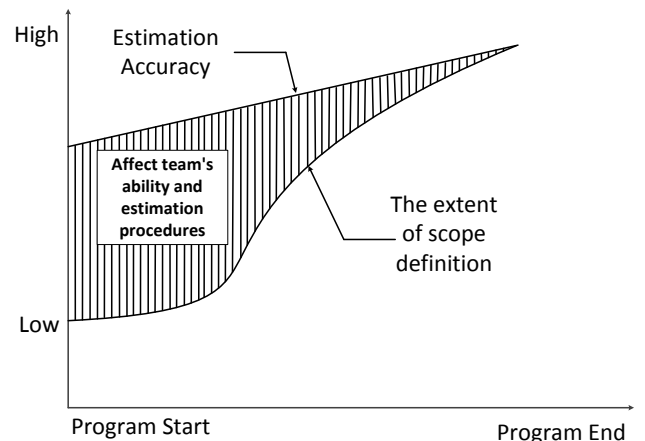


Fig. (5). Definition with a low degree of importance of team participation allowed project estimation.

**4. EXPERIMENTAL RESULTS**

**4.1. Engineering Project Management System Framework**

As shown in Fig. (6), the virtual organization's network structure and the project integrated information system are

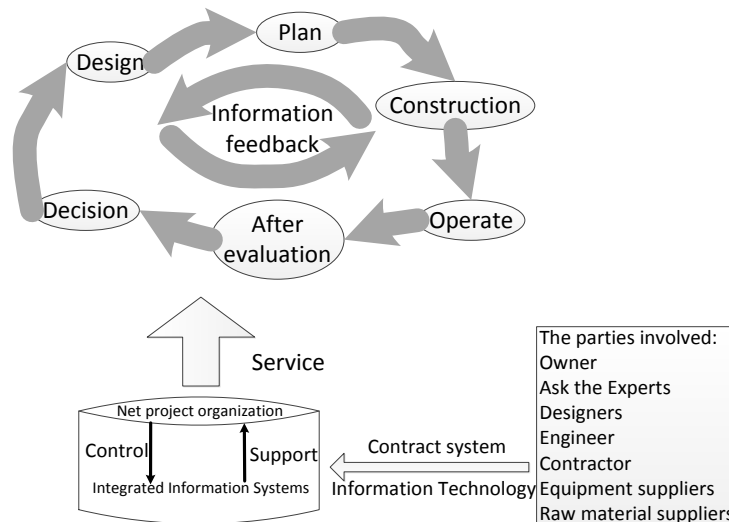


Fig. (6). The project life cycle integrated management system.

Table 2. The execution phase of the integrated project management elements and project management activities.

Project Management Elements	Project Management Activities
1. Scope	No
2. Duration	No
3. Cost	No
4. Quality	1. Quality assurance: regularly evaluate all projects, ensuring projects meet the relevant quality standards.
5. Human	1. Team Building: Developing individual and team skills in order to improve the level of implementation of the project work.
6. Information Communication	1. Information transfer: the project involves staff regularly to deliver the information they need.

the two cornerstones for the implementation of the project integrated management. For the project organization structure and project implementation related issues, a network is set up through the project contract integration management system. To ensure the efficiency of a project’s organization established by the project integrated management of virtual organization’s network structure and information integration system, the project will focus on the engineering project’s whole life cycle service.

The complexity of the engineering project management is due to dealing with large amounts of data and information related to the management process, query and communication. Because each project participant has been assigned based on their professional knowledge as a base to provide services, there is a clear division of labor, so, there is a need for close cooperation. To give full play to the professional knowledge of the participating parties, there is a need to have an integrated information system to ensure that the parties could obtain the needed information smoothly, and thus can make scientific decisions. Therefore, in order to take full advantages of the virtual organization’s network structure, it needs to have an integrated information system as a fast and efficient management tool.

#### 4.2. The Project Contract Mode

The coexistence of multi project management elements phenomenon also exists at the stage of the implementation process, see Table 2.

#### 4.3. Phases of a Project

With a project that the owners like to have since the beginning, through the design development to the end of construction, it has always been in a continuous state of change. Fig. (7) shows the various stages of a project life cycle. With the project advancement from one stage to another, more participants to join, and to get more and better results determine the scope, budget and schedule the information. In obtaining approval for the subsequent stages of the project, the initial stages have to be completed. In each stage, making all the work to be kept within the approved scope, budgeting and schedule planning is the responsibility of the project manager.

#### 4.4. The Feasibility Study

Experienced managers agree that in order to achieve savings and reduce the change time, it has to be designed initial-

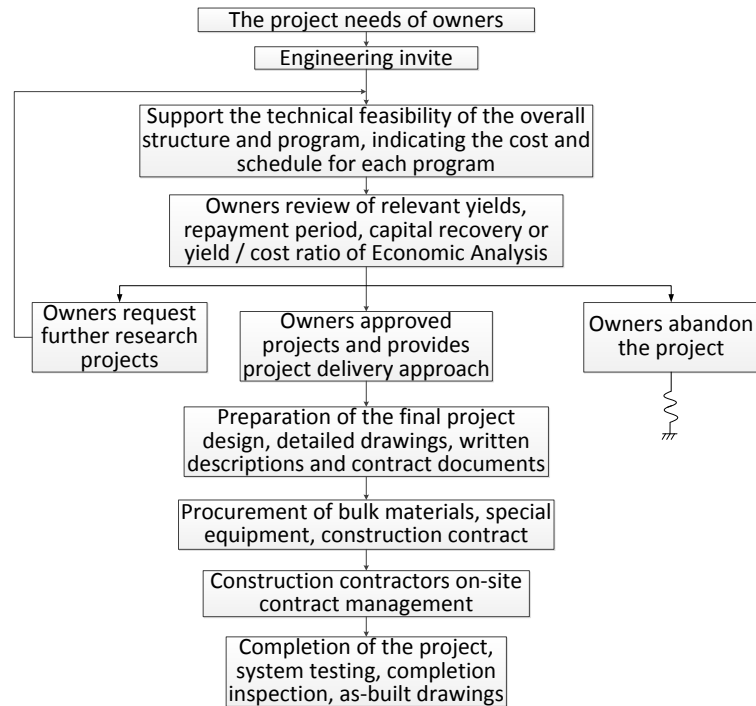


Fig. (7). The various stages of a project life cycle.

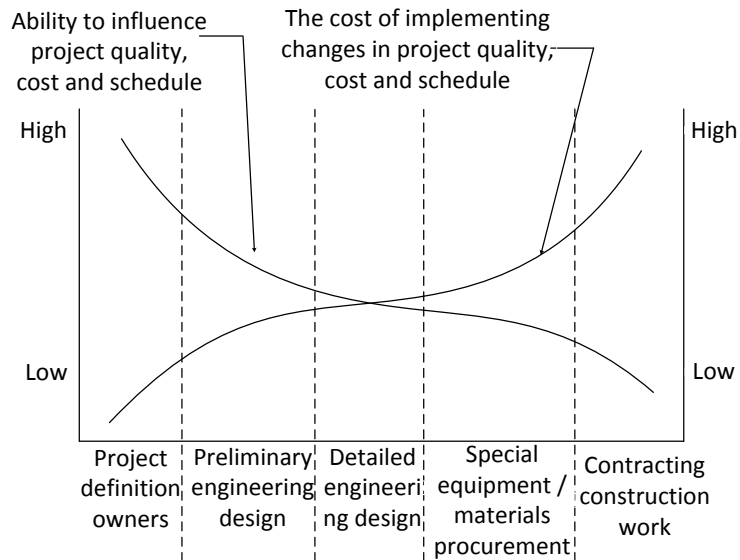


Fig. (8). The idea of the construction design.

ly at the startup of a project, rather than when the construction begins. This idea is shown in Fig. (8).

**CONCLUSION**

Project cost management is not only a part of engineering project management, but also necessary for the project management theory and practice in some conditions. However, space constraints and other reasons this topic has not been discussed sufficiently, detailing all the project management problems. The prerequisites for the engineering project cost management include: Project definition, the responsibility of the parties, the characteristics of project management, basic requirements of project management, the project manager's

task, project organization, project contracts, project feasibility study, the owners, the owners need and project objectives, project scope definition, project strategy, design companies and construction contractor selection.

**CONFLICT OF INTEREST**

The authors confirm that this article content has no conflict of interest.

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Declared none.

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