THE IMPORTANCE AND NECESSITY OF COST MANAGEMENT OF CONSTRUCTION PROJECTS

Alexandra-Marina BARBU
Economist, NIRD URBAN-INCERC Bucharest, e-mail: alexandra.marina.barbu@gmail.com

Mihaela SANDU
Economist, NIRD URBAN-INCERC Bucharest, e-mail: msandu1970@yahoo.com

Abstract. Constructions are the primary vector in the process of economic and social development and modernization. Estimating the costs of construction projects with high accuracy in the conceptual phase of project development is crucial for feasibility studies. However, a number of difficulties arise when performing the cost estimation in the conceptual phase. The major problems faced are the lack of preliminary information, the lack of the database on the costs of construction projects, the lack of data, the lack of adequate cost estimation methods and the involvement of uncertainties. The main objective of this research is to use state-of-the-art techniques to estimate the construction costs of the construction projects, to emphasize the importance of proper monitoring of the construction and to examine the processes of controlling the existing costs. This will help all staff realize the importance of construction monitoring and cost control.

Key words: construction costs, project cost management, cost estimation

1. Introduction

The construction sector is one of the most important sectors for one country's economy, mainly due to its ability to generate jobs, but also for its relationship with the productive infrastructure. It has been shown that the country's economic development is closely linked to the construction sector and vice versa, as this sector is characterized by its strong ties. In addition, construction is a cross-cutting activity for all other productive sectors, such as agriculture, industry, trade, services etc., because in all these civil works are needed to develop their activities. Therefore, the increase or decrease of construction activities strongly affects the related sectors (Allen, 1985), amplifying their effect on the entire economy of the country.

The construction industry is very complex in its nature as it contains a large number of members as customers, contractors, consultants, stakeholders, suppliers and others, also the construction industry is considered to be a very dynamic and complex industrial environment (Al-Zwainy, 2018).

In recent years, considerable progress has been made in improving management techniques, based on mathematical and scientific concepts, but the construction industry relies heavily on short-term empirical methods to solve the day-to-

day problems it faces (Kouskoulas and Koehn, 1974). This is the case for determining the overheads of construction contracts. Not only does management not use mathematical techniques, but there is no known quantitative approach to address these cost aspects in the industry.

This article is not intended as a comprehensive review of the literature, but as an investigation of the scheme to be followed to obtain information on the costs of one or more construction projects as soon as possible, minimizing errors in information management and processing and facilitating a number of complementary works related to the elaboration of the information, by storing orders for all data.

2. Construction projects and their management

Lots of projects begin with a great concept, enormous expense and huge struggle. A major contribution to the failure of projects is the lack of understanding of the field, time, cost and quality (Davis *et al.*, 1989; Carr, 1992; Bostenaru Dan, 2001, 2018; Stan, 2007; Hamma and Petrişor, 2017; Vasista, 2017; Ali *et al.*, 2018; Tache *et al.*, 2018; Moskolaï Ngossaha *et al.*, 2020; Suditu *et al.*, 2020).

In order to understand cost control in the management of construction projects, it is necessary to define project management. Therefore, this research takes into account the definitions of Munns and Bjeirmi (1996), which states: "Project management consists of defining work requirements, establishing the way of working, allocating the necessary resources, planning the execution of the work, monitoring the progress on deviations from the plan".

Gido and Clements (2012) say that "Project management involves planning, organization, coordination, direction and control of resources to achieve the project objective. The project management process consists of planning the work and then implementing the plan".

However, Kerzner (2013) says that project management consists of planning, organizing, directing and controlling the company's resources, which aim to achieve specific methods and objectives in a relatively short time. The graphical representation that accompanies this definition is presented in Fig. 1 and states that project management aims to manage and control project resources in a well-defined period, costs and performance, taking into account good customer relations.

One of the key resources in the above definition is cost according to the project management overview in the diagram in Fig. 1.

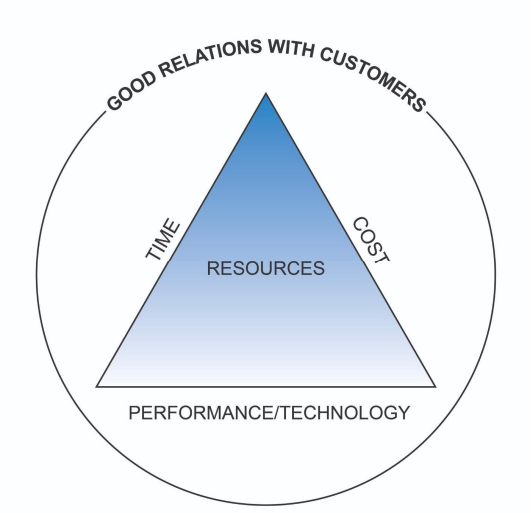

Fig. 1. Project management overview.

It is said that a project will be successful if its completion falls within the parameters in Fig. 1 (Atikinson, 1999).

Construction project management aims to identify, define, plan, organize,

coordinate and control the development of the project, from start to finish, in order to achieve (and exceed) customer requirements and expectations for the production of a functionally viable objective and financially, in compliance with the agreed quality standards, costs and deadlines (Postăvaru and Nemon, 2007; Sarb *et al.*, 2016) (Fig. 2).

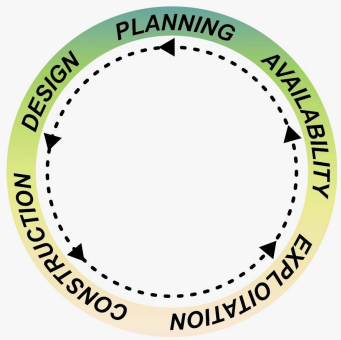

Fig. 2. The life cycle of a construction.

A construction project is a long-term productive process in which materials or other finished products are placed, assembled or transformed until a product - a construction or a civil work - is obtained, previously defined in plans, with well-defined specifications.

3. Cost control

Cost control is an action in which the construction cost of the project is handle by the proper approaches and procedures, so that the constructor does not experience failure when implement the project activities.

Cost estimation is a fundamental component of construction projects (Al-Zwainy, 2018; Souvik, 2016). In construction, most of the clients are involved in achieving totally practical facilities concluded in time, budget, quality and objective. A constructor who is capable to build in a predicted period of time and cost, at the right requirements and objective is an exceptional constructor. One of the objectives of cost control is to build at the cheapest possible costs, in line with the objectives of the project.

Accurate estimation will help project managers choose appropriate alternatives and avoid misjudging technical and economic solutions.

The veracity of cost evaluation increases by the deadline of the project because of the specific and exact data. The theoretical stage is the first stage of a project in which the demand is inspected, options are weight, project targets are settled and a backer is established (Wideman, 1995).

The expenses for this process come from deposits made for:

- Manufacture of every item described in plans and specifications.
- Management and strategy of the process.
- Implementation of the project in the proper and qualified situation.
- Marketing the result, as convenient.

A construction cost control system must focus on all elements of construction project costs. For a construction company, the cost elements to consider are:

- Material costs, which depend on the quantities required, the corresponding market prices and possible losses.
- Expenditure on staff (or labour) depends on the activity carried out, the salary rates, the costs associated with salaries, the organizational structure and the performance or productivity of the staff mentioned.
- The costs of construction equipment, which depend on the work to be performed, the fixed or ownership costs, the variable or operating costs

thereof and the performance or efficiency of using such equipment.
- Indirect costs, which depend on the logistical costs of the production support in the works and the fixed costs of the company, the latter are necessary to function as a strategic business unit.
- Other costs, which include concepts that can ultimately be reduced to a treatment similar to any of the three elements initially mentioned.

It is obvious that knowing the real costs of a work allows optimal decisions to be made that can correct the original direction or orientation of a project, as well as the execution and result of the construction project. This knowledge must be shared between all parties that may be involved in the process.

From the point of view of companies, the costs of a construction project are fundamental to achieve the expected utility or even to exceed it without making changes in terms of quality, safety and professional relations between the builder and customers, employees, suppliers, contractors and subcontractors.

From the buyer's point of view, the constant updating of project costs, as well as an initial estimate as close as possible to the final real costs, provide greater security in terms of the investment made.

4. The importance of cost control in the management of construction projects

Project planning consists in the complete definition of all possible works required by developing a project documented in a plan; so that it is easier to identify by its participants (Kerzner, 2013).

The organization requires adequate resources and sufficient staff to perform the work and organization of tasks; as well as an environment conducive to work motivation that encourages teamwork (Gido and Clements, 2012).

Management consists in implementing the necessary plans to achieve the project objectives, taking into account qualified staff, their training and assignment of responsibilities (Kerzner, 2013).

Control consists of comparing and tracking real progress with planning; monitoring the tasks assigned to the team; presentation of real progress, programs, costs and added value of the work performed and implementation of corrective actions. For the application of corrective actions, it is important to identify the problems in time before they worsen, and the solution must be immediate (Gido and Clements, 2012).

Cost control is a part of project management as an important function in determining finality. In this sense, cost control is defined as the recording and analysis of data in order to be able to take anticipatory corrective measures. Cost control involves managing their estimation; cost accounting, cash flow of the project; the company's cash flow; direct and indirect costs (Kerzner, 2013).

The objective of time control in construction projects is to comply with the planned schedule on time, because, for some reason, there are delays, which can lead to cost overruns (Simanjuntak, 2018). Nicholas and Steyn (2012) state that adherence to the performance schedule means maintaining the project over time. Even when projects are planned and estimated, they may be postponed for reasons beyond the control

staff, for example, necessary changes in the scope of the project, climate issues, lack of materials and variability in working time.

According to Olawale and Sun (2010), there are five major causes that obstruct cost and time management in construction projects; these causes correlate with plan adjustments, hazard and unpredictabilities, imprecise estimation of project scheduling, ramification of works and non-compliance by subcontractors.

The main problem that arises when trying to obtain information that is as accurate as possible and that is provided in a timely manner is that the procedures that are used to gather all the information, to analyze the source, to classify, process and review the information are often slow, inaccurate and complicated or, in many cases, there is no well-defined procedure by which to collect the necessary information.

In addition to the information related to the costs of the construction project, information can also be deduced with the aim of obtaining competitive advantages, which can be used as a negotiation tool. The construction industry, like other types of industry, is closely linked to the external environment, which directly influences costs and thus competitiveness (Peptenatu *et al.*, 2012a, b).

The updated information on the costs of the construction project, for the contracting party, provides the security of the investment to be made.

Regardless of the party involved in the project, up-to-date cost information is a real help.

Therefore, it is necessary to find a solution that is efficient, with a high margin of accuracy, which can also be easily applied by all parties directly involved in a construction project.

5. Types of costs

The importance of cost-effective estimation is vital for both the customer and the entrepreneur. Reasonable estimates are essential for the initial decision on the continuation or not of the project, ie the decision "goes/does not go" (Harrison, 1990).

The costs of a construction project are divided into four types, as follows:

- Direct costs.
- General expenses.
- Indirect costs.
- Commercial costs.

These costs define both large segments of a project and the scope that a budget can have, but have different ways of calculating, as each includes differentiated procurement (Table 1).

The construction activity can be fully budgeted on the basis of direct costs and overheads, but the common practice in this environment has also led to the calculation of costs indirect due to the close relationship between them and other costs and even in the calculation of commercial costs, although it is becoming more and more common for the latter to use services of expertise in financial and commercial matters.

The classification of construction costs is not a purely academic issue, because a proper understanding of it allows the correct organization of the activity and also facilitates the deduction of the necessary data.

Table 1. Types of construction costs.

Direct costs	Purchase of materials and manufactured products. Use of labour and equipment for performance, placement, transport, processing.
General expenses	Salaries or fees related to those who coordinate and direct the construction process, facilities, equipment and auxiliary staff that allow the project to be carried out properly.
Indirect costs	Development of projects or technical studies. Connection rights to public service networks, taxes associated with the activity.
Commercial costs	Capital interest or associated costs. Sales commissions and costs. Administration and management of the entire project.

Fig. 3 shows the structural classification of costs, detailing the main cost groups, the composition of each group and also the origin of the data calculation.

There is another way of classifying costs, namely the commercial theory of classification, which often causes confusion in the construction environment, because it is not focused on the origin and form of calculation, but on the influence that each type of cost produces in the final result, classified into direct costs, those that are proportional to the size of the work (materials, labour, taxes and public services) and indirect costs, those that decrease in importance on as the project increases, such as overheads, commissions and business costs. Fig. 4 illustrates this classification.

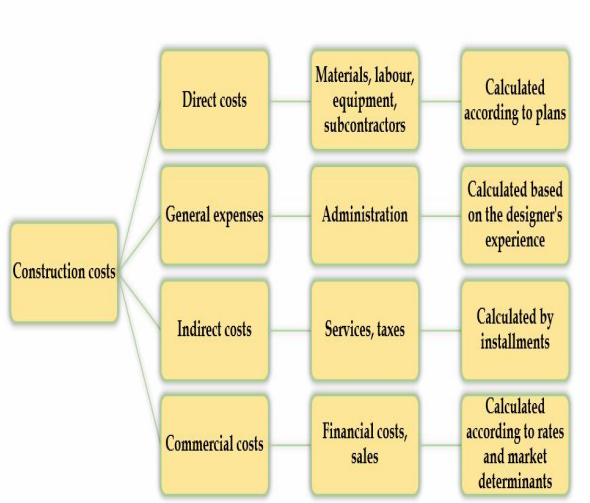

Fig. 3. Structural classification of costs.

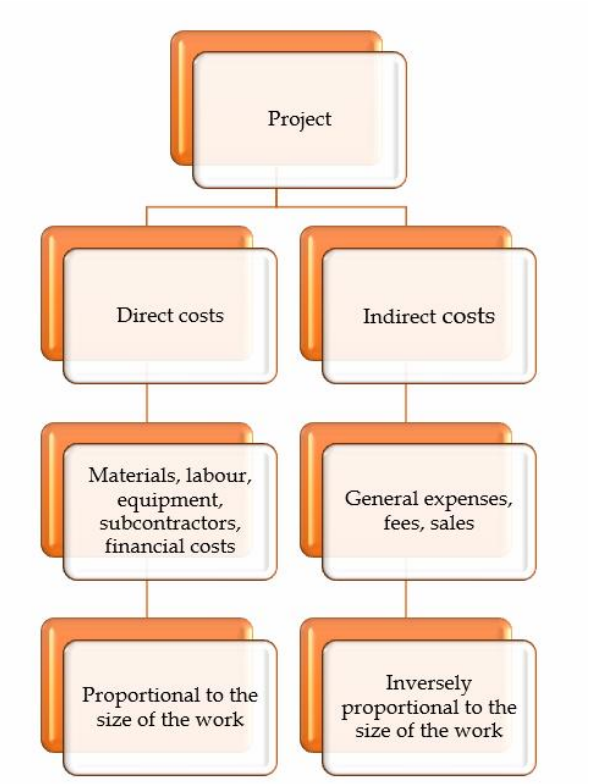

Fig. 4. Commercial classification of costs.

Within the costs of a construction project, several categories of costs are detected which are classified into: materials, labour, social taxes, contracts, subcontractors, equipment rental, transportation costs, payment for various services, administration and management costs (Danciu *et al.*, 2015).

6. Objectives

Given the problem and its importance, it is proposed as a general objective to develop an information management method that facilitates, as soon as possible, access to the costs related to the construction of a project.

This objective will be achieved by researching and assessing the current state of construction from estimating the costs of construction companies, taking into account the following questions:

1. What are the cost estimation methods used in these companies?
2. What are the factors or variables that affect the estimation of construction project costs?
3. What is the degree of documentation and retention of the information necessary for the development of construction projects for cost estimation?
4. What are the implementation approaches and types of contracts adopted for construction projects?

The main objective of project management is to ensure the completion of projects on time, in budget and with the planned level of performance, maintaining a good relationship with customers (Kerzner, 2013).

In this sense, this research aims to find a method that allows efficient control of costs and time in construction projects, which is articulated with the organizational structure and project management, so as to achieve cost optimization and a proper development of the construction project.

Although traditional methods such as the GANTT chart, PERT, CPM and software such as Ms Project, Primavera, among others have been implemented in recent decades, among others for project management, for cost and time control globally, nationally and locally, new methods are needed to control them (Ceptureanu, 2015), because there are many projects that experience excess costs and time in the construction process.

There have been numerous studies on cost control and time control in construction projects, which shows the scale of the problem and the need for control cost overruns and delays in execution time.

7. Conclusions

Over the years, and taking into account the rapid development of technology, but also the construction process, there is a need to have tools to exercise the strictest control of the construction project.

It is difficult to visualize that there is a construction project that is carried out without cost deviation or execution failures that may occur due to poor cost management, poor monitoring or poor supervision.

The primary aim of controlling the costs of a project is to achieve the greatest amount of profit within the allocate period of time and the adequate quality of the work.

Of particular importance in the construction process is the highlighting of the importance of monitoring construction projects and examining the existing cost control processes within the project, studying the cost control process within the construction project, identifying the cost control method frequently used by contractor at the

construction stage, as well as identifying the main problem facing the contractor in controlling costs on site.

Construction project cost management is a complicated system that requires the participation of all parties involved to operate in normal parameters. Through proper management, companies can strengthen the calculation and control of the cost of the project at all stages of construction and can achieve the goal of saving and reducing construction costs.

Only through cost-effective management can construction companies ensure the best economic benefits, while the goals of quality, progress and safety are achieved and can lay the foundations for their sustainable development.

Cost forecasting or planning is an effective cost management tool, which would be useful to be applied by contractors during the construction project.

To provide data for future cost management, an evaluation is often performed to prepare a detailed cost analysis of the completed project and to develop solutions to improve future design decisions. The captured cost data should also be returned to the owner's database to inform future estimates and budgets.

As information technology is constantly evolving, the need for a management tool that takes into account, with a strict respect for reality, the whole construction process, broken down at each stage of construction, so that most of the variables generated are analyzed it becomes more and more necessary.

In order to develop such an instrument as close as possible to reality, it is necessary to review the current procedure performed by a construction company, so that all cost documents help to model the total real cost of a work. Thus, it is considered necessary to detect failures and weaknesses, as well as the strengths of the cost management system used. This is opportune to know the cost of the project as soon as possible and to facilitate, in turn, decision-making.

The creation of such an easy-to-operate tool for both the builder and the customer facilitates the digitization of project cost information.

Given the importance of knowing cost information in the shortest possible time, but also its reliability, the need for a system that can control, in an easy and simple way, the costs of a construction project helps to obtain a very valuable information base in the field.

Although not based on a comprehensive review of the literature, current research reveals some theoretical aspects that lay the groundwork for future applied research or a detailed review of the literature.

REFERENCES

Allen S. G. (1985), *Why construction industry productivity is declining*, Review of Economic Statistics **117(4)**:661-665.

Ali A. G. M., Elsheikha A. A. A., Elbanna E. M., Peinado F. J. M. (2018), *An Approach to Conservation And Management of Farasan Islands' Heritage Sites, Saudi Arabia*, International Journal of Conservation Science **9(2)**: 245-256.

Al-Zwainy F. M. S. (2018), *A state-of-the-art survey to estimate construction costs in highway and bridge projects: analytical diagnostic study*, International Journal of Civil Engineering and Technology **9(5)**: 795-821.

Atikinson R. (1999), *Project management: cost, time and quality two best guesses and aphenomenon, it's time to accept other success criteria,* International Journal of Project Management **19(6)**:337-342.

Bostenaru Dan M. (2001), *Calculation of costs for seismic rehabilitation of historical buildings*, in: Brebbia C. A., Corz A. (Eds.), *Earthquake Resistant Engineering Structures III*, Book Series Advances in Earthquake Engineering **9**: 515-524.

Bostenaru Dan M. (2018), *Decision making based on benefit-costs analysis: Costs of preventive retrofit versus costs of repair after earthquake hazards*, Sustainability **10(5)**: 1537.

Carr R. I. (1992), *Cost, Schedule and Time Variances and Integration*, Journal of Construction, Engineering and Management **119(2)**:245-265.

Ceptureanu E. G. (2015), *Innovation and change management in Romanian SMES family business*, in: Popa I., Dobrin C., Ciocoiu C. N. (Eds.), *Proceedings of the 9th international management conference Management and Innovation for Competitive Advantage, November 5th-6th, 2015, Bucharest, Romania*, Bucharest Academy of Economic Studies Press, Bucharest, Romania, pp. 314-320.

Danciu M. I., Irimie S., Boatca M. E. (2015), *Strategic Social Entrepreneurship between Public and Corporate Management In The Context of Former Romanian Mining Colonies*, in: Soliman K. S. (Ed.), *Innovation vision 2020: From regional development sustainability to global economic growth*, International Business Information Management Association, Norristown, PA, USA, pp. 1950-1959.

Davis K., Ledbetter W., Burati J. Jr. (1989), *Measuring Design and Construction Quality Costs*, Journal of Construction, Engineering and Management **115(3)**:385-400.

Gido J., Clements J. P. (2012), *Administración exitosa de proyectos*, 5th Edition, Cengage Learning Publishing House, Ciudad de México, Mexico.

Hamma W., Petrişor A.-I. (2017), *Assessing the restoration of Sidi El Benna mosque in Tlemcen (Algeria)*, International Journal of Conservation Science **8(4)**:589-598.

Harrison H. L. (1990), *Advanced Project Management*, 2nd Edition, Gower Publishing Co. Ltd, London, United Kingdom.

Kerzner H. R. (2013), *Project Management: A Systems Approach to Planning, Scheduling, and Controlling*, 11th Edition, John Wiley and Sons Publishing House, New York, USA.

Kouskoulas V., Koehn E. (1974), *Pre-design Cost, Estimating Function for Building*, American Society of Civil Engineers **100(4)**: 589-603.

Moskolaï Ngossaha J., Houé Ngouna R., Archimède B., Pătraşcu R., Petrişor A.-I., Fouda N. M. (2020), *Methodological framework for defining the sustainability management process for urban mobility systems based on a system engineering*, International Journal of Digital Innovation in the Built Environment **9(1)**:1-21.

Munns K., Bjeirmi B. F. (1996), *The role of project manageent in achieving project success*, International Journal of Project Management **14(2)**: 81-97.

Nicholas J. M., Steyn H. (2016), *Project Management for Engineering, Business and Technology*, 5th Edition, Routledge Publishing House, London, United Kingdom.

Olawale Y. A., Sun M. (2010), *Cost and time control of construction projects: inhibiting factors and mitigating measures in practice*, Construction Management and Economics **28(5)**:509-526.

Peptenatu D., Merciu C., Merciu G., Drăghici C., Cercleux L. (2012a), *Specific features of environment risk management in emerging territorial structures*, Carpathian Journal of Earth and Environmental Sciences **7(2)**:135-143.

Peptenatu D., Pintili R. D., Drăghici C., Merciu G., Mateescu R. D. (2012b), *Management of environment risk within emergency territorial systems. Case study - the influence area of the Bucharest City*, Journal of Environmental Protection and Ecology **13(4)**:2360-2370.

Postăvaru N., Nemon N. (2007), *Construction management*, Matrix Publishing House, Bucharest, Romania.

Sarb A., Brad S., Stan O., Timoftei S. (2016), *Life-Cycle Building Costs Based on Particle Swarm Optimization*, Acta Technica Napocensis: Civil Engineering & Architecture **59(2)**: 42-51.

Simanjuntak M. R. A. (2018), *Analysis of Project Cost Management and The Effect On Cost Overrun In Construction Projects*, International Journal of Innovative Research in Science, Engineering and Technology **7(7)**:8049-8054.

Souvik R. (2016), *Estimation and Management of Construction Cost*, IOSR Journal of Mechanical and Civil Engineering **13(3)**:54-62.

Stan M.-I., Vintilă D. (2007), *Calculation of deformation estimated value for protection harbor construction to seismic application shaped through stationary random process*, Analele Universității Ovidius Constanța Seria Construcții **1(9)**:77-80.

Suditu B., Şercăianu M., Neagu M., Nenciu I. (2020), *The shadow of the "Great Earthquake" on a sustainable Bucharest. Shared responsibilities and disaster risk management*, Human Geographies **14(1)**:5-20.

Tache A. V., Sandu I. C. A., Popescu O. C., Petrişor A.-I. (2018), *UAV solutions for the protection and management of cultural heritage. Case study: the Halmyris archaeological site*, International Journal of Conservation Science **9(4)**: 795-804.

Vasista T. G. K. (2017), *Strategic cost management for construction project success: a systematic study*, Civil Engineering and Urban Planning: An International Journal **4(1)**: 41-52.

Wideman R. M. (1995), *Cost Control of Capital Projects*, BiTech Publishers Ltd, Richmond, BC, Canada.

Received: 27 July 2020 • **Revised**: 20 August 2020 • **Accepted**: 31 August 2020