

1 Introduction

COPYRIGHTED MATERIAL

Every business wants to reduce its costs so as to maximize its profits. Since construction is a type of business, it cannot be denied that every construction contractor is eager to reduce their costs. Construction contractors should also be able to accurately price each of their products and services (i.e., their projects), because accurate estimation of projects leads to the success of projects. Prior to addressing effectively managed costs, we need to have consensus on what comprises costs in a construction company.

1.1 **What comprises costs in a construction company?**

We usually define costs as a resource consumed to achieve a specific objective (Horngren *et al.*, 1999; Raffish and Turney, 1991). Costs are usually measured as the monetary amount that must be paid to acquire resources, i.e., goods and services.

Let us investigate the cost structure of a construction company (i.e., a general contractor) to establish what comprises a construction company’s costs. The cost structure of a construction company is the framework by which its home offices and each of its projects are budgeted and controlled. Figure 1.1 shows the typical cost structure of a construction contractor whose revenue is the sum of the revenue of all projects.

Home office overhead (General overhead)		Employees
		Facility and utility
		Others
Construction costs (Project costs)	Project overhead costs	Employees
		Facility and utility
		Others
	Project direct costs	Direct labor
		Direct material
		Subcontractor
		Equipment

Figure 1.1 Cost structure of a construction contractor.

As seen in Figure 1.1, a contractor's total costs consist of total construction costs and its general overhead costs. Total construction costs are the sum total of the construction costs of each project, which includes project direct costs and project overhead costs. The terms "overhead" or "overhead costs" are used to represent indirect costs in the rest of this book.

1.1.1 Construction costs (project costs)

Construction costs include both direct construction costs and the overhead (indirect) costs of each project. Direct project costs are the cost of materials, labor, and equipment, and subcontract costs. They are consumed and incorporated into the construction costs of a specific project. Project overhead costs include the consumption of resources used to support the activities of direct construction costs (e.g., field jobs), such as the salaries of project engineers.

All construction costs should be charged to a specific construction project. In addition, some of the home office resources used by a specific project are considered to be part of construction costs (i.e., project overhead costs). Suppose that 50% of an LEED (Leadership in Energy and Environmental Design) engineer's time in charge of green construction consulting at your home office is spent on three construction projects. Then, 50% of his or her salary needs to be allocated to these three projects according to the actual percentage of time spent on each project. In other words, 50% of the LEED engineer's salary is considered to be project overhead costs.

1.1.2 Overhead costs in a construction company

Although we used several terms in relation to cost structure (Figure 1.1), in general, costs can be grouped into direct costs and overhead costs. There are multiple definitions for direct and overhead costs in construction. One definition of direct costs is the costs expended in the realization of a physical sub-element of the project (Halpin, 1985). Although some practitioners use this definition based on the realization of a physical element on site, the definition is not widely accepted in the domain of cost accounting.

A generally accepted definition of direct costs uses the ability to track a cost to a cost object.¹ Direct costs of a cost object are related to a particular cost object and can be traced to it in an economically feasible (cost-effective) way (Horngren *et al.*, 1999). The term “direct costs,” when applied to construction accounting means costs which can be specifically identified with a construction job or with a unit of production within a job (Coombs and Palmer, 1989). This definition is consistent with the general definition of direct costs.

Overhead costs of a cost object, on the other hand, are related to a particular cost object but cannot be traced to it in an economically feasible way. Figure 1.2 illustrates cost categorization according to cost assignments. The term “cost allocation” is used to describe the assignment of overhead costs to a particular cost object (Raffish and Turney, 1991). The other important term is “cost object.” According to the definition of overhead costs, two criteria for discerning overhead costs are (1) cost object and (2) traceability.

The term “overhead costs” is still used in a vague manner in the construction industry, because our industry has more than one type of overhead cost. In other words, the same cost can be both an overhead cost and a direct cost, depending on the perspective of the observer.

For example, a superintendent’s wage is an overhead cost to a specific project at the project level, but it is also a direct cost to the

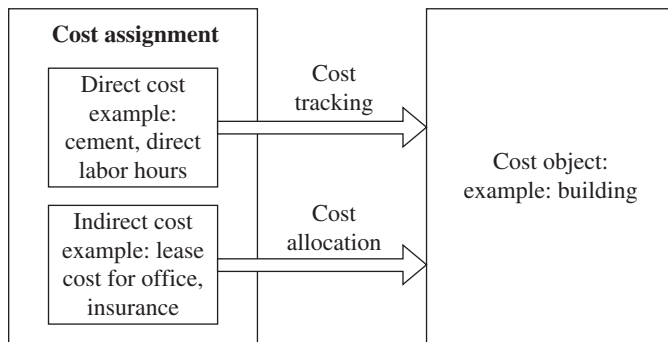


Figure 1.2 Cost assignment and classification.

¹ Cost object is defined as any product or service to which costs are assigned or tracked (Raffish and Turney, 1991).

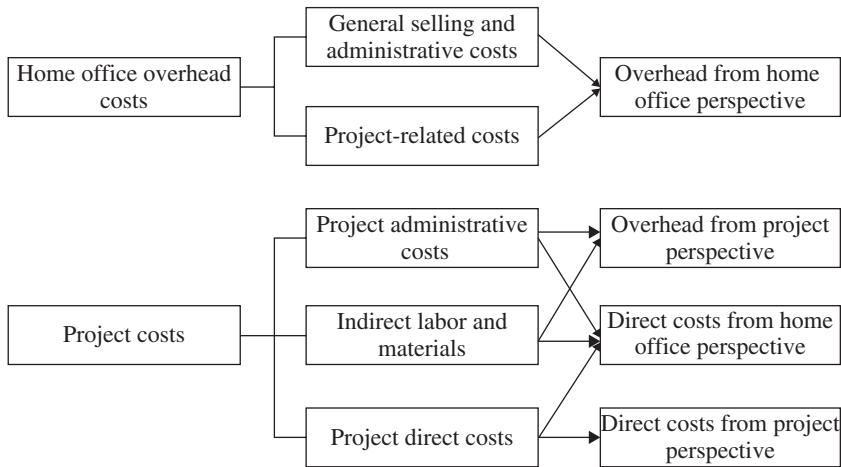


Figure 1.3 Cost classification of a construction contractor: duality of overhead costs.

specific project at the home office level. Figure 1.3 presents a general classification of construction costs showing the “duality” of overhead costs in the construction industry.

1.1.3 The cost classification in use and the duality of overhead costs

Despite definitions of cost classification, the construction industry does not seem to have a standard cost classification system of its own. Holland and Hobson’s survey results (1999) suggested that cost categorization is not standardized in construction.

Table 1.1 shows the result of a survey of general contractors’ cost categorization that was carried out by the authors’ research team. In Table 1.1, project overhead costs (P) and project direct costs (D) constitute project construction costs, and overhead costs (O) refer to general overhead costs. Table 1.1 also confirms that the construction industry lacks a standard system for categorizing costs.

Why doesn’t the industry have cost classification standards? The author’s observations and interviews with industry professionals suggest that categorization is mainly driven by the terms of contracts. In other words, commercial interests bound by contracts lead to cost classification. Suppose that your contract says that the owner is to reimburse all of the project’s direct costs.

Table 1.1 Cost classification examples in the construction industry (general contractor's perspective).

Cost Item No.	Item	Number of participants	P	D	O
1	Construction manager	15	60.0%	33.3%	6.7%
2	Superintendent	14	64.3%	28.6%	7.1%
3	Project engineer	15	60.0%	33.3%	6.7%
4	Material engineer	13	61.5%	30.8%	7.7%
5	Survey crew	12	66.7%	33.3%	0.0%
6	Quality staff	13	69.2%	23.1%	7.7%
7	Safety engineers	14	64.3%	28.6%	7.1%
8	Secretaries (field office)	13	69.2%	23.1%	7.7%
9	Automobiles	12	50.0%	33.3%	16.7%
10	Fencing and gates	11	81.8%	18.2%	0.0%
11	Temporary parking	13	61.5%	30.8%	7.7%
12	Project office	15	73.3%	20.0%	6.7%
13	Fabrication shop	9	33.3%	22.2%	44.5%
14	LEED engineer	8	37.5%	25.0%	37.5%
15	Rigging equipment	12	66.6%	16.7%	16.7%
16	Warehouse	14	50.0%	21.4%	28.6%

Note: P=project overhead costs, D=project direct costs, O=home office overhead costs.

In that case it is not surprising that you tend to include more cost items in the category of project direct costs. A lack of cost classification standards is one of the obstacles to the advancement of cost management practices.

1.2 Overhead costs in new business environments

Project overhead costs are increasingly important, as they have grown in recent years (Assaf *et al.*, 1999; Kim and Ballard, 2005). A number of driving forces have increased overhead costs (i.e., general overhead costs and project overhead costs) in recent years. The following four factors are identified as driving forces:

- Technical and managerial factor
A fragmented approach and activity-centered management has caused ineffective project delivery (Ballard *et al.*, 2011). In response to such challenges, Lean construction and Building

Information Modeling (BIM) have been adopted widely in the construction industry. Technical and management innovations such as BIM and Lean construction increase a contractor's overhead costs, both in terms of project overhead costs and general overhead costs, although they contribute to reducing total construction costs (mostly direct costs).

The fundamental principle of Lean construction is a reliable work flow² through a predictable production plan (Ballard *et al.*, 2007; Ballard, 1999). Achieving a reliable work flow via Lean construction usually involves intensive collaborative production planning such as “pull” planning and weekly work planning (Ballard, 1994). Other Lean construction principles such as just-in-time (JIT) delivery also require intensive planning efforts and close collaboration among project stakeholders; however, allocating more resources to collaboration and planning has an impact on project overhead costs. In addition, a contractor needs to hold educational workshops or training sessions to educate employees in preparation for Lean implementation.

Building Information Modeling has been practiced in inter-organizational collaborations among architects, engineers, and construction contractors (Dossick and Neff, 2011). In addition to the hardware and software expenses that arise with this system, a construction company will need more staff to operate the system, as well as having to meet the costs of associated collaborative processes, such as coordination meetings (Eastman *et al.*, 2008).

In addition to using the Lean and BIM systems, the construction industry has also adopted information technology in many areas. Some examples of technology include ERP (enterprise resource planning), various material tracking systems such as bar codes and RFID (radio frequency identification), and automation. These investments in information technology inevitably increase overhead costs, despite increased management efficiency and labor productivity.

- Social factor

The concept of green building or sustainable construction has emerged across the industry as society's awareness of

² The movement of information and materials through networks of interdependent specialists (Lean Construction Institute, 2016).

sustainability issues has grown. The construction industry, one of the nation's largest industries, is making an effort to reduce its environmental impact by adopting sustainable design and construction practices (Bae and Kim, 2007). The exemplary practice widely adopted in the industry is LEED (Leadership in Energy and Environmental Design).³ When LEED is implemented in a project, it impacts not only direct costs (e.g., environmentally friendly materials) but also overhead costs. Examples of overhead costs incurred due to LEED may include professional fees and documentation costs (General Service Administration, 2004). Those soft costs (overhead costs) can be absorbed either into project overhead costs or into general overhead costs, depending on the attributes of each specific cost.

Additional overhead costs due to LEED certification will vary depending on the project type and context. Administration of the LEED certification process and documentation of LEED credits is an added cost directly associated with LEED certification. The USGBC estimates that these administration costs range from \$20,000 to \$60,000, depending upon project size, complexity, and project team experience (USGBC, 2009). Although various case studies on the cost of LEED exist, it is clear that society's awareness around green and sustainability issues increases overhead costs in our industry.

- Contractual factor

The fragmented approach of procurement systems for construction projects, known as design-bid-build, has been a dominant delivery method. However, such a fragmented procurement approach has affected project effectiveness in that it does not encourage integration, collaboration, and communication among organizations participating on a project (Love *et al.*, 1998). In particular, decoupling of design and construction has exacerbated communication and collaboration problems in complex and uncertain projects (Ballard *et al.*, 2011).

In response to the challenges caused by fragmented procurement, alternative delivery systems have been actively

³ LEED is a certification program supporting sustainable design and construction practices developed and endorsed by the non-profit U.S. Green Building Council (USGBC) in the building construction industry. (USGBC, 2009).

adopted both in the private market and in the public market. Alternative delivery systems include (1) CM/GC⁴ or CM-at-Risk,⁵ (2) Design-Build, and (3) the Integrated Project Delivery System.

The Design-Build Institute of America (DBIA) published a report on the use of the design-build delivery method in the United States in 2013 (Design-Build Institute of America, 2013). The study reports that in 2010, 41% of non-residential building projects in the United States were delivered using design-build, an increase from 30% in 2005. The same report shows that the use of design-bid-build declined from 67% in 2005 to 53% in 2010. The number of projects built with the CM-at-Risk system grew from 3% in 2005 to 6% in 2010 (Design-Build Institute of America, 2013).

The use of alternative delivery systems inevitably increases overhead costs, for the following reasons:

- 1) The involvement of more contractors in the design phase (or preconstruction services) increases the need for resources in preconstruction services, such as design professionals or preconstruction managers.
- 2) The negotiated contract, as an alternative to low-bid contractor selection, requires marketing resources to build relationships with potential customers.

In addition to the various factors which increase a contractor's overhead costs, we need to pay attention to the construction environment, where the use of specialty contractors has increased (Lock, 2000). As part of this trend, general contractors have lost control of management of project direct costs on projects where all the work divisions are subcontracted. As compared to projects where general contractors use directly hired work in most work divisions, more coordination is required to manage various specialty contractors, each with its own commercial interests. As a result, learning to effectively manage overhead costs (both general overhead costs and project overhead costs) is key to making a general contractor competitive in the market.

⁴ Construction Management/General Contractor Delivery Method.

⁵ Construction Management-at-Risk.

1.3 Role of overhead cost management

Most guidelines for managing overhead costs are for tax, financial reporting, and claim purposes (Coombs and Palmer, 1989). How overhead costs are allocated affects financial reporting and tax accounting (Coombs and Palmer, 1989). In fact, allocating overhead costs to different sectors or projects is a way of maneuvering a company's taxable profits. Controlling overhead costs from those perspectives is important, but overhead cost control from a managerial perspective has rarely been studied.

In the previous section, we discussed the importance of managing overhead costs in current construction environments. In addition to those issues, it must be asked: what is the purpose of managing overhead costs in a construction firm?

1.3.1 *Overhead costing system should provide accurate costing on cost objects*

One of the fundamental functions in managing overhead costs is to accurately allocate them to the proper cost objects. Cost objects can vary depending on the purposes of the costing system. As a contractor, your cost object can be each project when allocating your general overhead costs. Each work division on a specific project can be a cost object if you want to investigate the efficiency of management activities at the project level.

Accurate allocation of general overhead costs to projects is important for two reasons. First, accurate allocation of general overhead costs provides a general contractor with accurate information on profits for each project. Accurate profit information on cost objects allows contractors to identify where they lose or make money through accurate allocation of overhead costs. In addition, accurate profit information gives a general contractor insight into marketing strategies that focus on profitable project sectors. In negotiated contracts, such information becomes important in building and nurturing relationships with potential customers, as compared to low-bid contracts where such information is not as important.

Second, accurate cost information on each project enables a general contractor to estimate costs on future projects more accurately, putting him or her in a superior position in bidding for a job. The current practice of applying a predetermined

percentage to all types of projects may lead to inaccurate cost estimation, which can make the contractor less competitive in the market. Although some contractors use different ratios for general overhead costs on different types of projects when bidding, inaccurate allocation of overhead costs makes bidding numbers inaccurate, thereby making them less competitive in the market.

1.3.2 *Overhead costing system should contribute to reducing total costs without sacrificing value*

As discussed, assuming that all work divisions are subcontracted using a fixed-cost contract, there is not much room to reduce construction direct costs. However, reducing overhead costs is not always a great way to maximize profits. The fundamental role of overhead costs (i.e., the consumption of overhead resources) is to effectively support fieldwork on sites. Overhead costs include scheduling, estimating, inspection, supervising fieldworks, safety training, etc.

These are support activities that enable fieldwork, although they are not directly value-adding. For example, production planning or weekly scheduling requires multiple activities, each consuming overhead resources. The value delivered by this consumption of overhead resources is to give field crews job assignments. It is necessary to understand activities, as well as the values associated with the consumption of overhead resources, before tackling the challenge of reducing some of your overhead costs.

The key is to understand activities which consume overhead resources and the value of the activities performed. You should be careful that the value of activities associated with overhead costs does not get lost as you try to reduce your overhead costs. Your overhead costing system needs to help you to achieve a reduction in overhead costs without sacrificing the value that those costs generate.

1.4 Structure of this book

This book is organized in six chapters, including this one. Chapter 2 describes the problems of current cost accounting methods for managing overhead costs and the methodology of

activity-based costing (ABC). Chapters 3, 4, and 5 deal with various cases to which ABC could be applied. Chapter 6 provides guideline for your ABC implementation.

References

- Assaf, S., Bubshait, A., Atiyah, S., and Al-Shehri, M. (1999). "Project overhead costs in Saudi Arabia," *Cost Engineering*, 41(4), 33–38.
- Bae, J. and Kim, Y. (2007). "Sustainable value on construction projects and lean construction," *Journal of Green Building*, 3(1), 156–167.
- Ballard, G. (1994). "The last planner," *Northern California Construction Institute Spring Conference*, Monterey, California.
- Ballard, G. (1999). "Improving work flow reliability," in *Proceedings of the 7th Annual Conference of the International Group for Lean Construction*, Tommelein, I. D. (editor), 275–286.
- Ballard, G., Kim, Y., Azari, R., and Cho, S. (2011). *Starting from Scratch: A New Project Delivery Paradigm*, Construction Industry Institute, Research Report 271, Austin, TX.
- Ballard, G., Kim, Y., Min, L., and Jang, J. (2007). *Lean Implementation at a Project Level*, Construction Industry Institute, Research Report 234, Austin, TX.
- Coombs, W. and Palmer, W. (1989). *Construction Accounting and Financial Management*, 4th edn, McGraw-Hill, Inc., New York, NY.
- Design-Build Institute of America (2013). *Design-Build Project Delivery Market Share and Market Size Report*, Washington, DC.
- Dossick, C. and Neff, G. (2011). "Messy talk and clean technology: communication, problem-solving and collaboration using Building Information Modeling," *The Engineering Project Organization Journal*, 1(2), 83–93.
- Eastman, C., Teicholz, P., Sacks, R., and Liston, K. (2008). *BIM Handbook: A Guide to Building Information Modelling for Owners, Managers, Designers, Engineers, and Contractors*, John Wiley and Sons Ltd, New Jersey.
- General Service Administration (2004). *LEED Cost Study Final Report*, Contract No. GS-11P-99-MAD-0565, Washington, DC.
- Halpin, D. (1985). *Financial & Cost Concepts for Construction Management*, John Wiley and Sons Ltd, New York, NY.

- Holland, N. and Hobson, D. (1999). "Indirect cost categorization and allocation by construction contractors," *Journal of Architectural Engineering*, ASCE, 5(2), 49–56.
- Horngren, C., Foster, G., and Datar, S. (1999). *Cost Accounting*, 10th edn, Prentice Hall, Upper Saddle River, NJ.
- Kim, Y. and Ballard, G. (2005). "Profit-point analysis: A tool for general contractors to measure and compare costs of management time expended on different subcontractors," *Canadian Journal of Civil Engineering*, 32(4), 712–718.
- Lock, D. (2000). *Project Management*, 7th edn, Gower, Vermont, VM.
- Love, P., Gunasekaran, A., and Li, H. (1998). "Concurrent engineering: a strategy for procuring construction projects," *International Journal of Project Management*, 16(6), 375–383.
- Raffish, N. and Turney, P. (1991). "Glossary of activity-based management," *Cost Management Journal*, Fall, 53–63.
- U.S. Green Building Council (2009). *Green Building Design and Construction*, U.S. Green Building Council, Washington, DC, 645 pp.

