

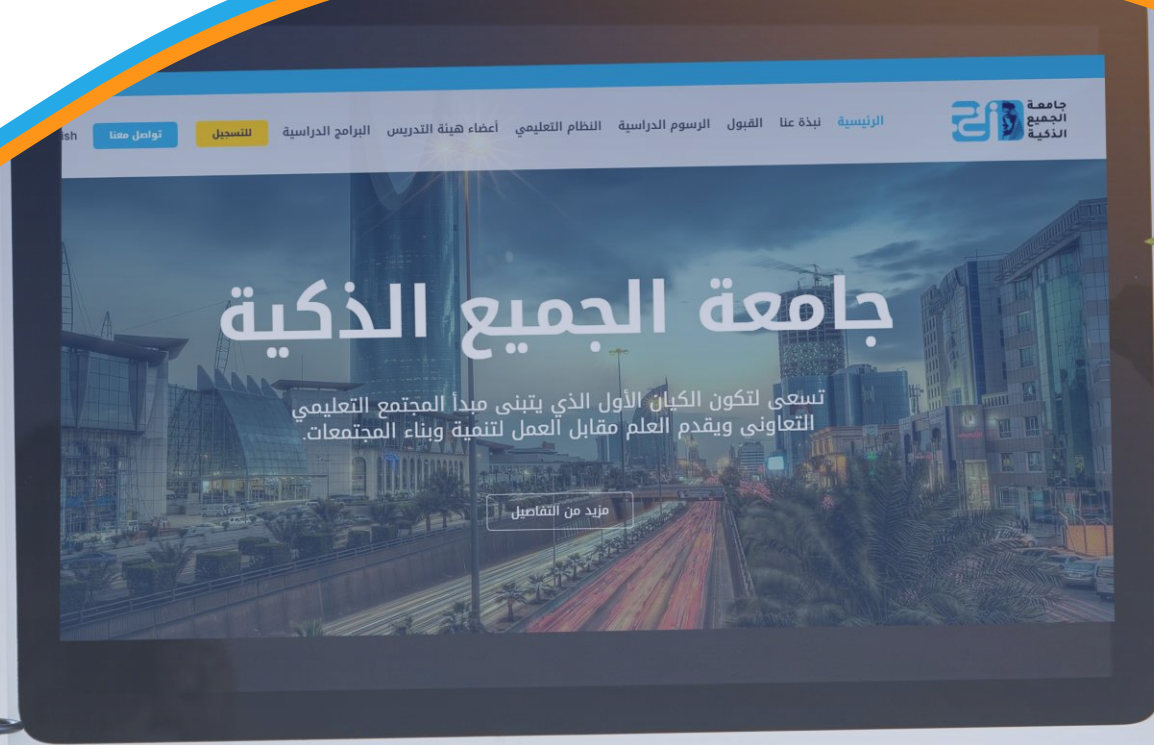


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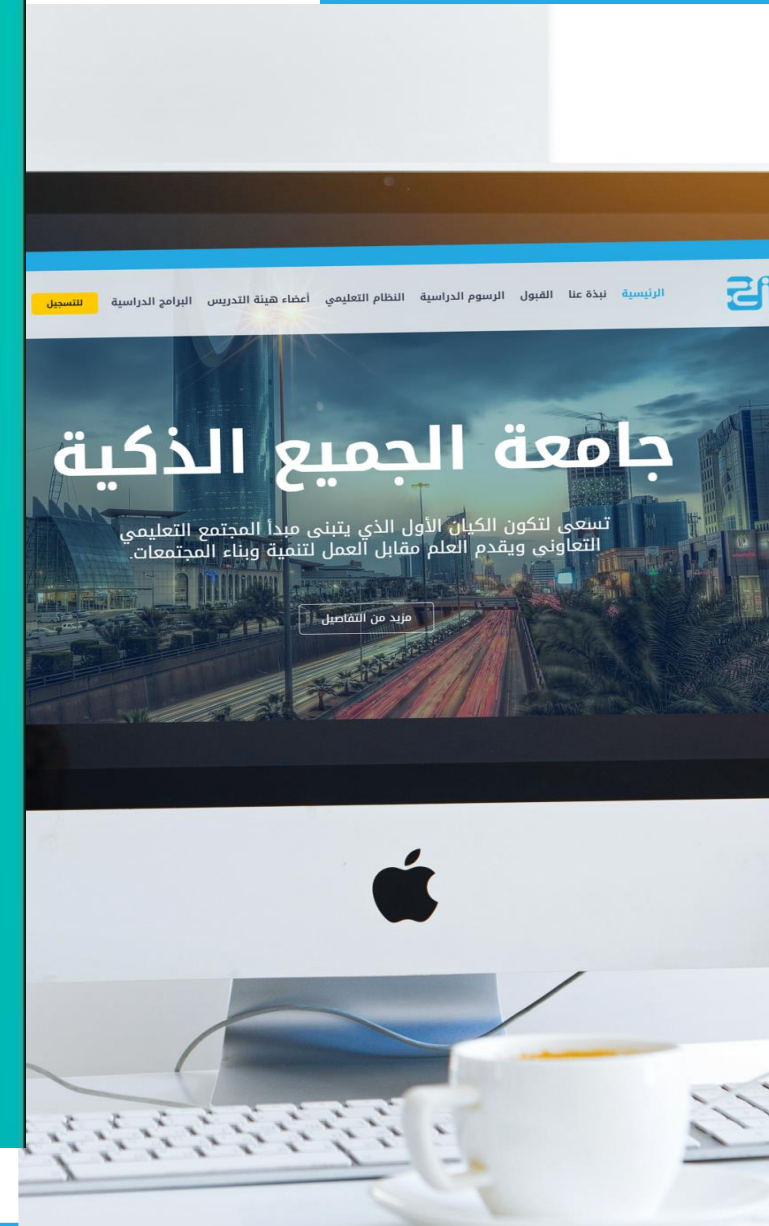
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Introduction to construction management



Introduction

This chapter has been included along with other Cost Accounting and Financial Management topics to provide a brief overview and introduction to current construction management (CM) processes. It is important to introduce the reader to a few additional CM terms and processes before diving deeper into the accounting of construction. Neither this chapter on CM nor the next introductory chapter on estimating are meant to be stand-alone treatises on those very important topics. Each of those deserves their own book or separate class on just those areas. **Our focus here is on the relationship between project management and estimating, and other CM topics, as it relates to jobsite cost accounting and financial management.** There are many good books on project management and estimating including Management of Construction Projects.



The focus of construction management here is on the role of the project manager (PM) as an individual. Many concepts and terms from one (CM or PM) apply to the other. The CM and the PM are both builders, but so are many other members of the built environment (BE) team. The term 'builder' is too generic; everyone on the project, including the owner, architect, general contractor (GC), and the craftsmen contribute to the building process and each is a 'builder' per se. The owner-architect-GC-craftsmen were in the beginning all one and the same; they were the builder. The qualities of the ancient builders included creativity, resourcefulness, intuition, problem solving, among others. They just 'knew' what it took to get the job done. Later the owner and the builder, or master-builder, split into two separate functions. It was the owner who provided the need and the builder who satisfied those needs, in this case, with a building or a home. At that time the master-builder was both the designer and the builder, similar to the current design-build (DB) delivery method described later and shown in Figure 3.4



The next split was between the builder and the designer. The builder would evolve into today's construction management or general contractor companies. The design element would also later be split into architecture and engineering. Each of those also has many sub-divisions today and has been listed later. There are also many additional levels of specializations within the GC's organization as discussed later. **The project owner, sometimes also referred to as the client, and the lead designer or architect, and the general contractor or construction manager are the three major participants in any organization or delivery method utilized in the BE as will be discussed in the next section.** There are many other BE participants including specialty engineers and consultants such as waterproofing or elevator consultants; the list is quite extensive. Many of these are listed here:

- * Structural engineer
- * Civil engineer
- * Mechanical engineer
- * Electrical engineer



* Kitchen consultant

- Landscape architect
- Interior designer
- Elevator consultant
- Accountant
- Bank
- City inspectors
- Third-party inspectors
- Commissioning agent
- Envelope consultant/waterproofing

This chapter will describe the delivery and procurement methods the client chooses to use as well as pricing and contracting options which the contractor must incorporate. Different types of general construction organizations are also introduced as well as the role of project management and project managers and the risks they must evaluate when considering a potential construction project.



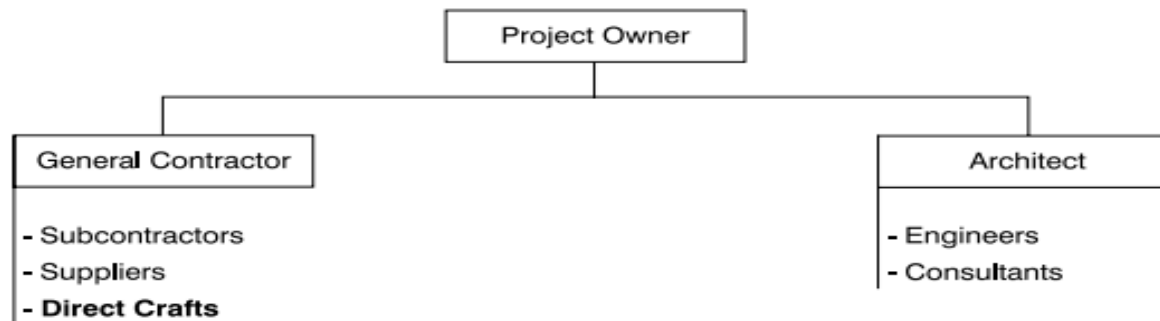
Delivery and procurement methods

The three major companies and/or individuals which are **the primary responsible parties in any construction project include the project owner or client, the designer (architect or engineer), and the general contractor**. The relationships among these participants are defined by the delivery method used for the project. **The choice of delivery method is the owner's**, but it has an impact on the responsibilities of the contractor's jobsite team, especially their financial responsibilities. The project owner selects a delivery method based on their experience and the risk they are willing to absorb or pass to either the GC or the design team. This section examines the four most common delivery methods. Each of these different arrangements has an effect on how the GC will conduct its jobsite project ...anagement operations, including cost accounting. Basic differences in bid and negotiation procurement processes are also introduced along with the four major design phases which coincide with various delivery and procurement options.



Traditional general contractor delivery

The most common method of project delivery is the traditional method and is represented in the simple Figure 3.1 organization chart. The owner has separate contracts with both the designer and the general contractor.



. There is no contractual relationship between the designer and the GC. **Typically, the design is completed before the contractor is hired in this delivery method.** The GC's project manager takes the point to obtain the project drawings and specifications, develop a cost estimate and construction schedule, establish a cost control system to manage construction financial activities, and manage the construction site office. A traditional GC employs a mix of subcontractors and direct craftsmen.



Construction management delivery

There are two basic construction management delivery methods. **One is the agency CM and the other is the at-risk CM.** The agency CM does not employ any subcontractors or direct craftsmen and the pure at-risk CM employs all subcontractors and no direct craftsmen; different than the mix employed by the traditional GC as described earlier. The project owner has three separate contracts (one with the designer, one with the general contractor, and one with the construction manager) in the agency construction management delivery method as shown in Figure 3.2. The CM acts as the owner's agent and coordinates design and construction issues with the designer and the GC. The CM usually is the first contract awarded,



and he or she is involved in hiring both the designer and the GC. In this delivery method the GC usually is not hired until the design is completed. The GC's project manager has similar responsibilities to those listed for the traditional delivery method. **The primary difference is that the GC's PM interfaces with the agency CM instead of the owner, as is the case in the traditional method.** The agency CM is sometimes referred to as the owner's representative. Since the construction costs do not run through the agency CM's accounting books, this version of the CM does not have any financial risk. In the construction manager-at-risk delivery method, the owner has two contracts (one with the designer and one with the construction manager) as illustrated in Figure 3.3. This delivery method is also known as the construction manager/general contractor (CM/GC) delivery method.



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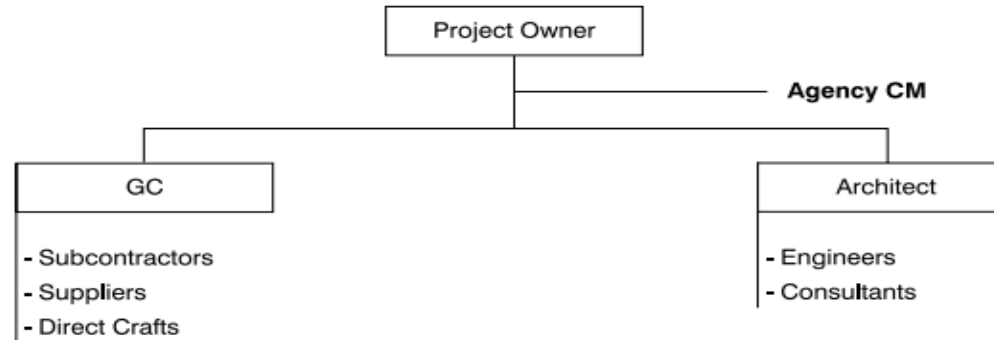


Figure 3.2 Agency construction management organization chart

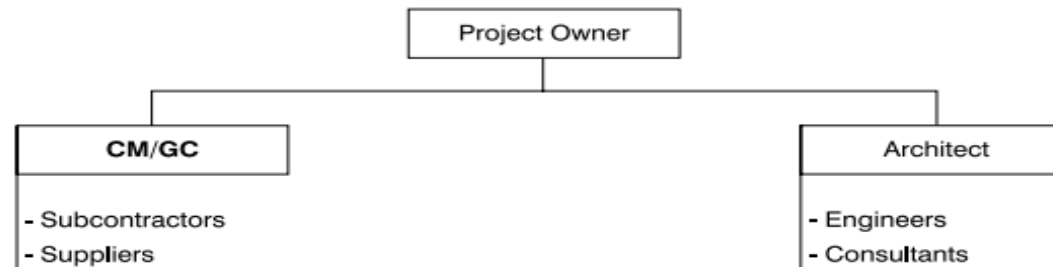


Figure 3.3 Construction management at-risk organization chart



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In this case, the designer usually is hired first, but the CM/GC is also contracted early in the design development to perform a variety of preconstruction services, such as cost estimating, constructability analysis, and value engineering studies. Once the design is completed, the CM/GC constructs the project. In some cases, construction may be initiated before the entire design is completed. This is known as fast-track or phased construction. The CM/GC's project manager interfaces with the designer and manages the execution of preconstruction tasks and assumes similar responsibilities to those in the traditional method once construction starts.



Design-build delivery

The project owner has a single contract with a design-build (DB) contractor for both the design and construction of the project in the DB delivery method, as diagrammed in Figure 3.4. The DB contractor may have a design capability within its own organization, may choose to enter into a joint venture with a design firm, or may hire a design firm to develop the design. Construction may be initiated early in the design process using fast-track procedures or may wait until the design is completed. **In this delivery method, the GC's project manager interfaces with the owner and manages both the design and construction.** This method is very similar to the ancient master builder concept discussed earlier in this chapter. There are other versions of DB which extends the contractor's involvement further into the life-cycle of the building, including: UÊ DBO – Design, build, and operate, UÊ DBOM – Design, build, operate, and maintain, and UÊ DBOMT – Design, build, operate, maintain, and transfer.



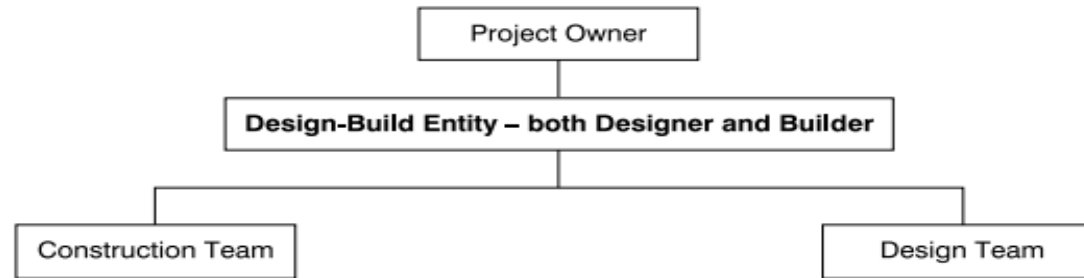


Figure 3.4 Design-build organization chart

There are a variety of other delivery methods, **some of which are hybrids of these four**. The integrated project delivery (IPD) is a relatively new concept where all three prime parties sign the same agreement and share in the same risks . The project owner contracts with several general contractors or major subcontractors at the same time.



This often includes a site work contractor, building shell and core contractor, tenant-improvement contractor, mechanical contractor, electrical contractor, and/or others. The multiple-prime delivery method usually requires a construction-experienced project owner to act as their own construction manager.

Another alternate delivery process is known as public-private partnership (PPP or P3). This process combines the resources of a private entity, such as a real estate developer which may own a piece of property, with the needs of a public client, such as a university looking to build a research laboratory. The private developer will build and operate the facility for benefit of the university which will sign a long-term lease guaranteeing the developer's pro forma will work out. The public client does not need to go through the sometimes complicated and often litigious lump sum bid process with the P3 delivery method.



Procurement

Project owners solicit or procure both construction and design team members utilizing either bid or negotiated procedures. Public project owners are often required by law to use an open bidding process to allow all contractors an even chance of successfully landing new work. Private owners can use whatever procurement method they choose, bid or negotiate, but often solicit contractors they have had good experience with in the past, and may ask a select few or even only one contractor to submit a bid or negotiated proposal. Both private and public owners may use a prequalification process to develop a short list of contractors to either bid or negotiate after they have submitted a list of qualifications which suit that specific project.



Prequalification helps reduce the client's risk of an unqualified contractor submitting a bid which is too low for them to successfully complete the project.

There are risks and advantages associated with either bidding or negotiating for the owner, architect, and contractor.



Design phases

All elements of any given project are not designed at the same time; different elements are started earlier, and some proceed faster than others and include additional levels of detail. There are five major design phases that most built environment projects experience. In some cases, programming and conceptual design may be combined into one phase for a total of four phases. These design phases influence all of the other introductory construction management topics discussed in this chapter including delivery, procurement, contracting, and pricing methods differently with respect to when the contractor estimates the project and when and how the contractor is chosen and begins their cost accounting processes. The design phases include:

- * Programming,
- * Conceptual design,
- * Schematic design (SD),
- * Design development (DD), and UÊ Construction documents (CDs).



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Additional design definition and detail is added at each of these levels which allow the contractor to develop more accurate estimates and reduce contingencies. Ideally this additional detail also reduces the client's risks. Budget estimates and negotiation with a construction manager/general contractor is more common early in the design process, whereas the traditional delivery method and bid procurement process matches up best at the completion of the last phase, construction documents.



Pricing

There are several methods for pricing contracts used in the construction industry but four are the most prevalent and others are hybrids of these four. The choice of which to use on any particular project is made by the owner after analyzing the risk associated with the project and deciding how much of the risk to assume and how much to pass on to the contractor. Contractors want compensation for risk they assume and usually do so with increased fees or estimating contingencies. The most common pricing methods include:

- * Lump sum (LS),
- * Unit price,
- * Cost plus fixed fee or cost plus percentage fee, and
- * Cost-plus with a guaranteed maximum price (GMP).



Lump sum, or stipulated sum, contracts are awarded on the basis of a single lump sum estimate for a specified scope of work. Unit-price contracts are utilized for heavy-civil projects when the exact quantities of work cannot be defined. The designer estimates the quantities of work, and the contractor submits unit prices for each work item. The actual installed quantities required are multiplied by the bid unit prices to determine the final contract price but only after project completion. Cost-plus contracts are used when the complete scope of work cannot be defined. All of the contractor's project-related costs are reimbursed by the owner, and a fee is paid to cover profit and contractor home office overhead. This is also known as a time and materials contract. A guaranteed-maximum-price contract is a cost-plus contract in which the contractor agrees not to exceed a specified cost.



Project owners choose which method they want their contractors to price a project for a variety of reasons, including the completeness of the design, the complexity of the project, and the owner's experience in managing construction projects. Each of these pricing models also has a significantly different effect on jobsite cost accounting. The GMP pricing method is utilized for the hotel case study and examples in this book as it introduces the reader to a variety of cost accounting operations that the other pricing methods do not include, especially lump sum. There are many good project management and estimating books available, including MOCP, which include a more detailed discussion of these contract pricing methods, some of which is elaborated on in the next chapter on estimating.



Construction contracts

The construction contract is the most important construction document. It has significant impacts on how costs are accounted for, especially in an open-book contract. It is a legal document that describes the rights and responsibilities of the parties, for example, the owner and the general contractor. Five things must be aligned for a contract to exist:

- * An offer to perform a service,
- * An acceptance of the offer,
- * Some conveyance, i.e. transfer of a completed building for money,
- * A legal agreement, and
- * Only authorized parties can sign the agreement, for example the officer-in-charge or chief executive officer (OIC or CEO)



The intent of the contractual agreement and the contract documents describe the completed project and the terms and conditions the parties (usually the project owner and the general contractor) must adhere to in order to accomplish the work. There typically is not a detailed description of the sequence of work or the means and methods to be used by the contractor in completing the project. The contractor is expected to have the professional expertise required to understand the contract documents and select appropriate subcontractors and qualified craftsmen, materials, and equipment to complete the project safely and achieve the specified quality requirements. For example, the contract documents will specify the dimension and sizes of structural steel columns and beams, but will not provide the design for erection aids, such as erection bolts or erection seats or hoisting and safety considerations.



. The contract documents usually include at least the following 28 Introduction to construction management five essential elements. They are listed here in what had been considered a relative order of precedence, but today most see them as complementary; all of these documents must work together:

1. The contract agreement,
2. Special or supplemental conditions,
3. General conditions,
4. Technical specifications, and
5. Drawings.

The terms and conditions of the relationship between the primary parties are defined solely within the contract documents. These documents should be read and completely understood by the contractor before deciding to pursue a project. They also form the basis for creating a project estimate and schedule. To manage a project successfully, the project manager must understand the organization of the contract documents and the contractual requirements for his or her project



This knowledge is essential if the PM has any expectation of satisfying the expectations of his or her company executives as well as that of the project owner. The contract agreement itself is either a generic standard template or a specially prepared document to suit a specific project owner or a specific project. Most government agencies use standard formats for developing construction contract documents. Federal and state agencies typically have standardized general conditions and contract language. Many private owners use contract formats developed by the American Institute of Architects (AIA) or the new family of construction contracts called the ConsensusDocs headed up by the Associated General Contractors of America (AGC) and other contractor associations. **Contracts should not be signed until they have been subjected to a thorough legal review. This is to ensure that the documents are legally enforceable in the event of a disagreement and that there is a clear, legal description of each party's responsibilities.** Standard contract agreements have typically been developed by attorneys and have been tested in the legal system and deemed fair to the parties that willfully execute them.



The contract documents have a significant impact on the responsibilities of the jobsite project team and effect accounting processes. Specific requirements are contained in the general conditions and special conditions of the contract. A particular project could utilize many potential combinations of delivery, procurement, pricing methods, contract formats, and contractor organizational structures as shown in Figure 3.5.

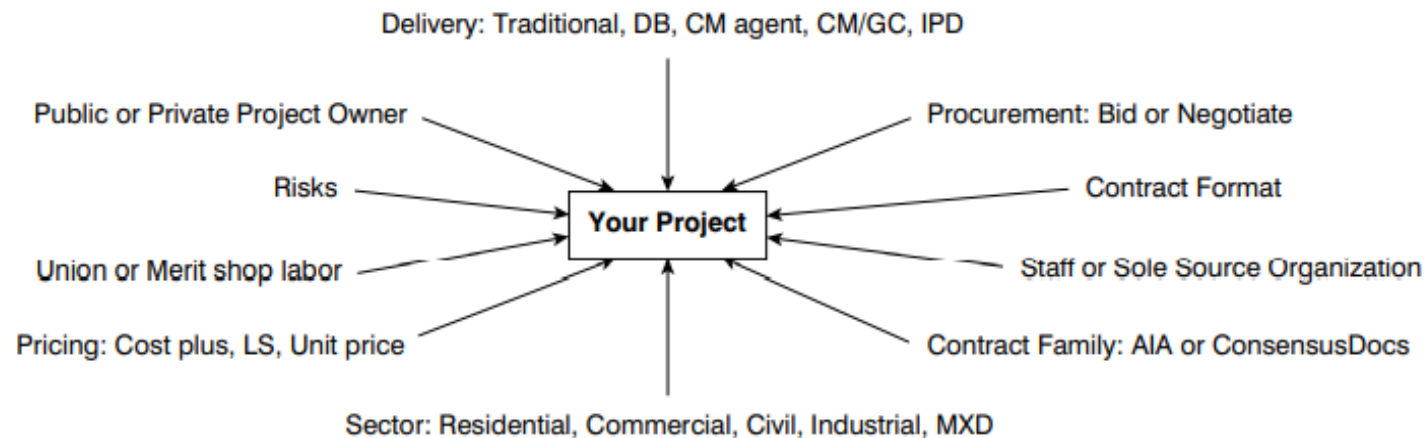


Figure 3.5 Delivery options



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There are several different accounting implications or rules the contractor must adhere to which will be defined in the contract documents. costs.



Closed-book lump sum projects are not auditable and are not subject to these clauses and articles. Both closed- and open-book contracts will define change order markups in their contract as well. Excerpts from AIA A102 Articles 7 and 8 pertinent to how the project will be estimated and accounted for follow.

Article 7, Costs to be reimbursed:

7.2.1: Wages of construction workers employed at the site (i.e. carpenters and laborers)

7.2.2: Salaries of supervisory personnel stated at the site (i.e. superintendent, project manager, and jobsite cost accountant)

7.2.4: Taxes, insurance, benefits for personnel (i.e. labor burden)

7.5.2: Rental charges for equipment

Article 8, Costs not to be reimbursed:

8.1.1: Salaries of personnel stationed at the office (i.e. CEO and accountants and marketing staff)

8.1.2: Expenses of the principal office, other than the site office

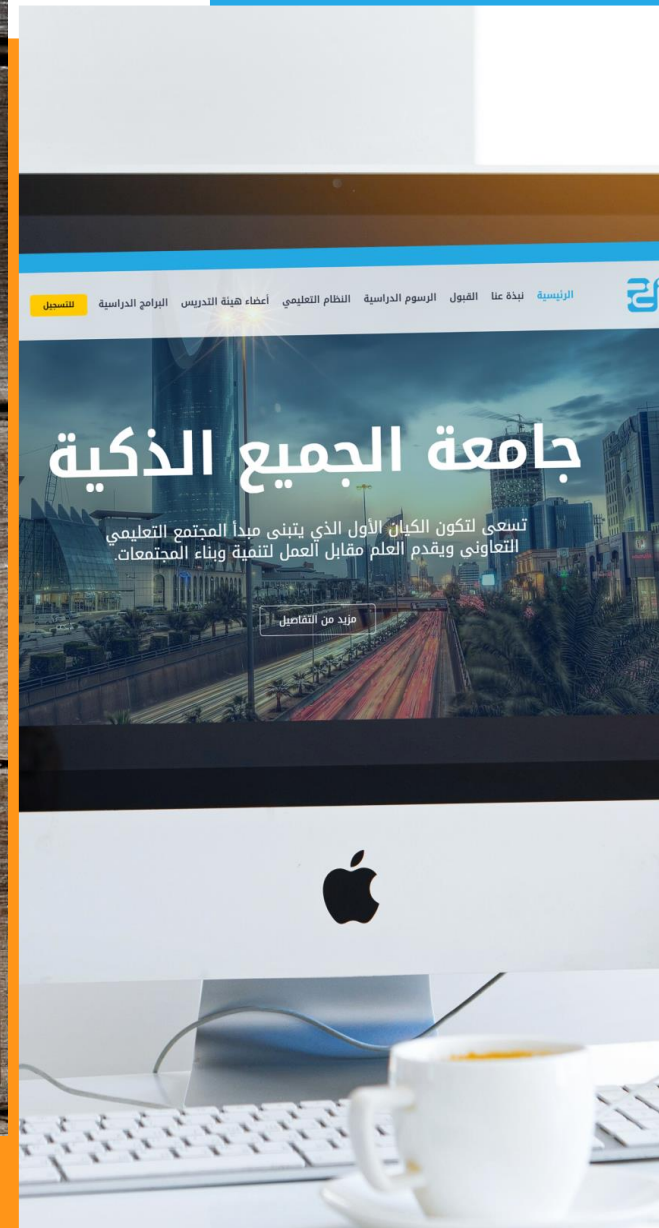
8.1.3: Home office overhead and general expenses



Thank You



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