

# **Factors Affecting the Selection of the Appropriate Construction Management at Risk Contractor**

**Ahmed Sari**

*American University of Sharjah, Sharjah, United Arab Emirates*

**Sameh Monir El-Sayegh, PhD, PMP**

*American University of Sharjah, Sharjah, United Arab Emirates, [selsayegh@aus.edu](mailto:selsayegh@aus.edu)*

## **ABSTRACT**

The selected contractor has a big influence on the project and its success. Hence, the selection of the appropriate contractor is a critical and vital task. Construction Management at Risk (CM@R) is one of the most popular and increasingly adopted delivery methods. The CM@R company is unique because it performs two main tasks: construction management and general contracting. There is a number of models and lists that can be used to select the appropriate contractor when using the traditional design-bid-build and design-build delivery methods. However, there are no models that assist owners in selecting the unique CM@R company. Selecting a CM@R company according to a general contractor factor list can easily mislead the evaluator to choose a wrong contractor. This paper presents the selection factors for the appropriate CM@R company. These factors are generated through extensive literature review. Construction Management at Risk selection factors can be used by owners to evaluate different CM@R proposals. The factors are divided into three groups: general factors, construction management factors and general contracting factors. Each of these groups is divided into categories and each category is divided further into attributes (selection factors). This paper also proposes a framework that assists owners in selecting the appropriate construction management at risk contractor.

**Keywords:** Construction Management at Risk, Project delivery methods, Construction management, Contractor selection

## **1. INTRODUCTION**

Owners are always trying to choose the most suitable delivery method for their project due its impact on project success. Project delivery method can be defined as a system for organizing and financing design, construction, operation and maintenance activities that facilitates the delivery of a good service (Miller et al., 2000). In view of the fact that the delivery method is the procedure and the tool of conducting any project, it was and still being a main topic of research and a fertile area of study. "The construction industry has been searching for effective project delivery method to maximize project performance" (Ibbs et al., 2003). Various types of delivery methods have been created through history in which each aimed to guide the project to its successful completion smoothly where the great 'value of money' can be achieved.

Design/Build, which is regarded as a new and alternative method, was the oldest approach during ancient times in Mesopotamia and Egypt and it was known as the Mater Builder approach. This continued to be the most commonly used project delivery method until the late 19th century. Design/Bid/Build (traditional method) approach appeared, as one of the most accepted delivery methods especially for public sector projects, when the advances in science and technology allowed the field of architecture and engineering to become two different professions and the project separated into a well-defined design and construction phases. Due to the shortcoming

of the traditional delivery method (Design/Bid/Build), alternative delivery methods have emerged such as Construction Management, Construction Management at Risk (CM@R), Build/Operate/Transfer and others.

Construction management at risk (CM@R) is one of the very unique methods that have been created. It involves three main parties: the owner, the designer and the CM@R contractor. More than one delivery method has been created to involve construction management but not like CM@R did. It assigned the management to the general contractor GC who is the most capable member to handle the management part, where constructability studies, value engineering and preconstruction services can be provided more efficiently. CM@R also allows fast tracking. This unique method, in which the contractor is the main and most important member, is now one of the most popular and widely adopted delivery methods “construction management at risk is a delivery system where the owner contracts separately with a designer and a contractor ... the owner select a contractor to perform construction management services and construction work.” (Knocher and Sanvido, 1998). General contractor’s selection is a tricky and hard decision. “Selection of the main construction contractor is a critical and vital task, it depends largely on the basic philosophy of ‘the right person for the right job’.” (Palaneesaran and Kumaraswamy, 2000). It is mainly based on two typical kinds of systems, single criterion system in which the only criterion is the price, and the multi-criteria bidding system which considers other criteria besides the price.

Although construction management at risk is one of the most popular and increasingly adopted delivery methods, there is no unique contractor ‘selection model’ as other delivery methods have. This paper comes to fulfill the need for such selection model which serves the increasing number of owners who adopt ‘construction management at risk’ as a delivery method for their projects. This paper introduces factors that influence the selection of the most appropriate ‘construction management at risk’ contractor. The factors were generated through extensive literature review. The paper also proposes a framework that can be used by owners to select the appropriate construction management at risk company.

## **2. REVIEW OF RELATED LITERATURE**

Selecting the contractor is a tricky and hard procedure “Bid evaluation is one of the major challenges that face owners and consultants in the public and private sectors” (Alsugair, 1999). For that reason, several models and frameworks have been created to help owners in evaluating contractors’ bids and select the most appropriate one. Russell (1996) reviewed a number of methods that have been developed. Cost (price) was considered, for a long time, the main evaluation factor. Although the lowest bidder system protects the public from improper practices, it has certain disadvantages. These include unreasonable low bids either accidentally or deliberately or unqualified contractor which cause extensive delay, cost overrun, quality problems and increased number of disputes. Over the years some modification to the lowest bidder system were made, such as reasonable bidder, public interest and prequalification list which open the door to other evaluation methods to be adopted instead of the single criterion system lowest bidder system.

The Multi Criteria Bidding System is an evaluation method that considers not only the price as the awarding reason, but also considers other important attributes. “The key of Multi attributes system is that the selection process of the contractors is based on more attributes such as, bid price or cost, time, quality, managerial safety accountability, competence and sufficiency of contractors.” (Liu et al., 2000). The main concept of the Multi Attributes Bidding System is that the selection process of the contractors will be based on more attributes than just the price, and the successful bidder will be the one who has the highest combined bidding value of the multiple attributes. The scores of those attributes are transformed into values and those values of all the attributes are totaled to give the combined bidding value.

One of those models is the performance predicting system for contractor selection, proposed by Alarcon and Mourgues (2002). The proposed system utilizes a methodology that predicts the potential performance of the contractors under analysis. The model takes into account the most important characteristics of the contractors and projects that influence project performance such as contractor organization chart, contractor resources, project location, project type, and others. Similar framework was introduced by Alsugair (1999). This framework proposed a bid evaluation framework by identifying 36 evaluation factors which grouped into main 9 classes such

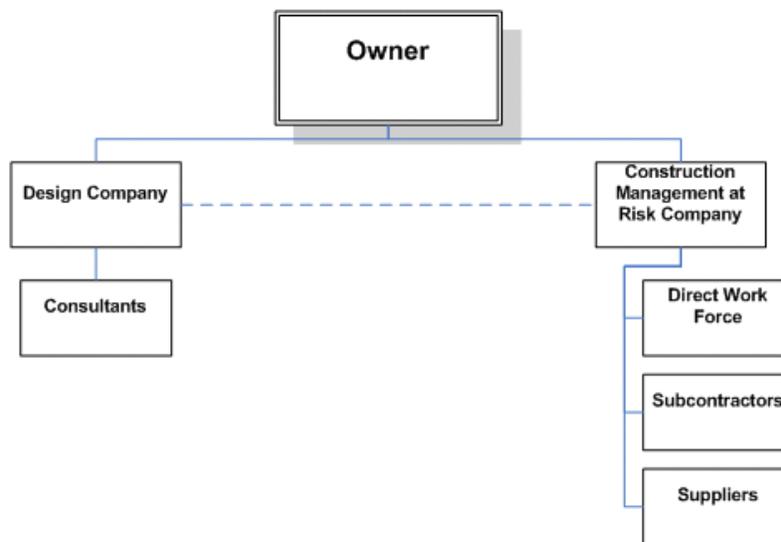
as financial evaluation of the bid, bid understanding, completeness of bid documents and others. Those factors were presented in question forms where the evaluating score results from the score given against each question.

Another model, created by Russell (1996), was the two steps prequalification by performing qualification in two steps. Step one is contractor screening using the dimension – wide strategy method, while the second step is evaluating the remaining contractors using the dimensional weighting method. Also prequalification formulas are used to determine a contractor’s capabilities based on certain variables or characteristics such as contractor previous experience in similar projects, contractor financial standing, and others. Russell and Skibniewski (1990) have developed QUALIFIER-1; a computer program that uses the dimensional weighting method which involves identifying a relative importance (weight) for each factor. Contractors’ bids are then rated based on these weights. Relative importance can also be applied to a composite decision factor (group of related factors) and to factor within a composite decision factor. Russell et al (1990) has developed an expert system prototype QUALIFIER-2 based on the dimension – wide strategy method. This involves defining certain value for each factor as a threshold in which the contractor will be excluded if he/she does not meet the threshold in at least one of the factors.

In contrast, no equivalent efforts were spent in developing models to help in evaluating contractor’s bids when a specific delivery method is selected. Apparently few studies have focused on the contractor selection aspects of the popular Design/Build. A selection model for Design/Build delivery method was developed by Palaneeswaran and Kumaraswamy (2000). Although Construction Management at Risk, as a delivery method, is one of the most popular, modern and widely used method, it does not appear to have a unique model of contractor’s bids evaluation.

### 3. CONSTRUCTION MANAGEMENT AT RISK

The Construction Management at Risk (CM@R) has been introduced in the 1980s when previous approaches started to be unacceptable by owners. This is mainly due to their insufficient design result, increased errors and disputes and ultimately longer schedule. Interaction, particularly during the design phase, was extremely low. Construction management at risk as a project delivery method was created to provide input to the designer to increase constructability of designs and to decrease schedule duration through overlapping of the design and construction phases. Kknocher and Sanvido (1998) emphasized that the contractor usually has a significant input in the design process. Figure 1 shows the contractual relationships for this delivery method.



**Figure 1. Construction Management at Risk Contractual Arrangement**

In general, CM@R creates a collaborative and non-adversarial environment that uses the wisdom, experience, and creativity of the architect and the CM. The CM has the opportunity to review the design as it progresses and to offer suggestions based on his experience and expertise. The procedure is more interactive with all key project players than the low-bid system. Construction Management at Risk or CM@R is gaining popularity, especially in the construction of the large projects such as schools, airports, and sports arenas.

The purpose of CM@R is to reduce the risk of cost overrun and schedule creep and to expedite the construction process without compromising quality. The construction manager works with the designer as a team during the design phase. Then continue to be the project main contractor beside to initial construction management role. There are some advantages to the owner from using the CM@R delivery method:

- Risk is reduced for the architect and owner.
- Produce a more manageable and predictable project cost and schedule outcomes.
- Centralizes responsibilities.
- The owner benefits from the CM's experience both during design and construction.
- Allow for an early start to construction by phasing the work.
- Results in better quality construction because the selection of the CM is based on record of performance in the same type work.
- Pricing is fair, and there is an atmosphere of trust because the project is "open book".

#### **4. SELECTION FACTORS**

The set of selection factors that affect the owners' decision of the most appropriate construction management at risk contractor are divided into three groups. Each group is divided further into categories that contain the set of attributes (selection factors). Figure 2 shows the three main groups and their associated categories. The attributes (factors) in each group are discussed in the following sections.

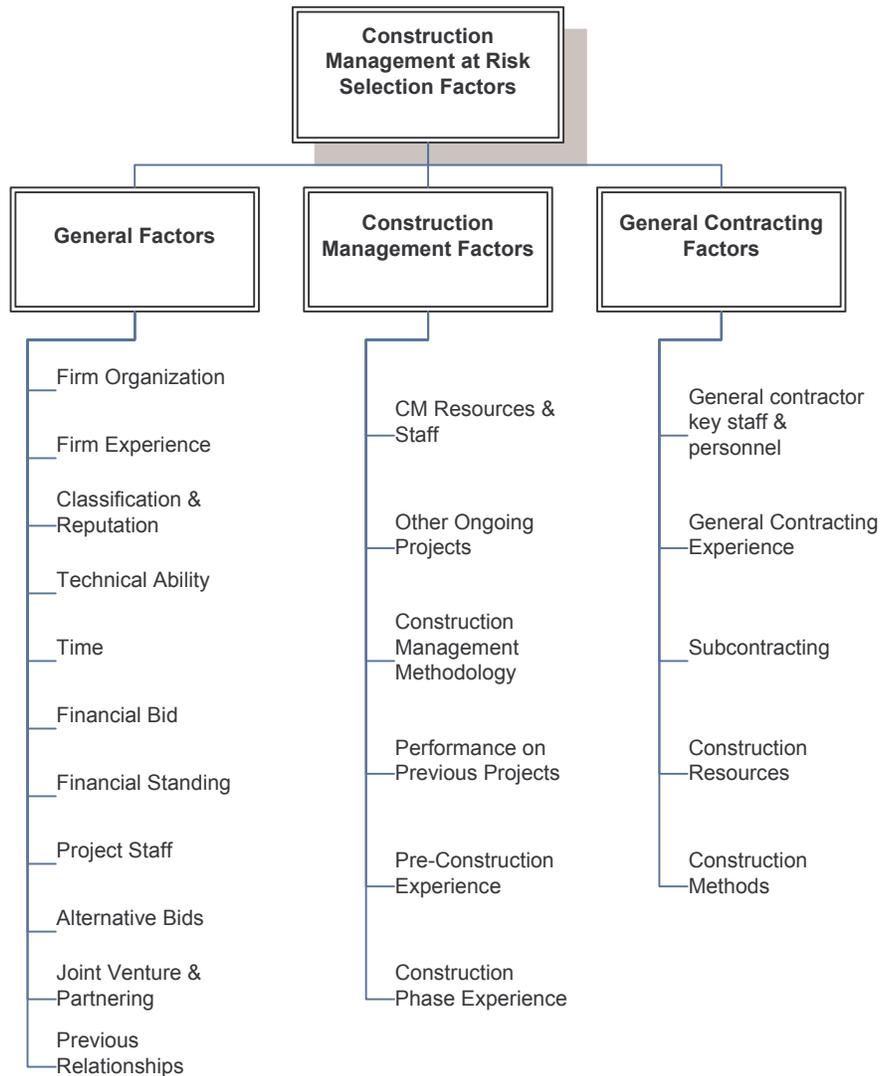
##### **GENERAL FACTORS**

This category includes several factors related to the overall company. These are general factors that can apply to any delivery method. The first category refers to the firm organization. This category consist of a number of attributes (factors) such as the total number of staff, the number of full-time vs. part-time staff, the number of professional staff, the organization structure, operational procedures and the hiring and training program. The second category is related to the firm's experience. This category includes attributes such as the total number of years in existence, the number of projects performed in the recent years, the total number of completed of CM@R projects, the number of ongoing projects, experience of similar construction, total construction volume, previous projects' list, previous customers' list, geographic territory and familiarity with the local labors, suppliers, and market.

The third category refers to the company classification and reputation. It includes attributes such as firm classification, references, reputation in keeping commitments in projects, previous claims and disputes, failure to complete contracts or contractual delay and pending or past construction related legal actions. The technical ability category includes attributes such as research & development (R&D), innovation and IT application. The time category includes factors such as commitment to complete the project within the anticipated period and the commencement date.

The financial bid category includes factors such as submission of the lowest price, payment and its terms, bonding capacity and Insurance, unbalanced bid, financial reservations, financial capability to execute, request for a special financial arrangements that disagree with the tender arrangements and if the CM@R company offered any price deduction if owner is prepared to make a substantial advance payment. The financial standing category includes attributes such as the CM@R company's capital compared to the actual project cost and financial standing as evident from the financial statements. The anticipated project staff category includes factors such as responsibility and degree of involvement of the project key staff and key staff qualifications. The alternative bids category include factors such as financial, technical, quality and time for the proposed alternatives. The joint venture & partnering category includes factors such as the firm's willingness to carry out the project in joint

venture with another firm(s), willingness to subcontract one or more of its main responsibility and the willingness to form partnering agreement with the owner. The previous relationships category includes factors such as the availability of prior business relationship with the owner and the past experience of client/CM@R relationship.



**Figure 2. Construction Management at Risk Selection Factors**

**CONSTRUCTION MANAGEMENT FACTORS**

The construction management at risk company provides construction management services to the owner during the design and construction phases. This group deals only with the construction management component of the project as a separate function from the other duties of the CM@R contractor. The first category is related to the construction management resources and staff. This category includes a number of attributes such as the total number of construction management personnel, the number of full-time vs. part-time staff, the proposed number of construction management office-staff, the proposed number of construction management site-staff and key staff qualification background, experience, etc.

The other projects category includes factors such as the total construction volume that the organization has performed as only construction management firm and the total number and value of the currently undertaken projects in which firm is performing only construction management services. The construction management

methodology category includes factors such as the overall plan to control the project time, review process, and time control techniques, the overall plan to control the quality, review process, and quality control techniques, the overall plan to control the project cost, review process, and cost control techniques, the overall plan to value engineering and the techniques to be used, change management plan, information management plan and communications management plan. The performance on previous projects category includes cost control examples, quality control examples, value engineering examples and time control examples.

The pre-construction phase experience is an important category and includes attributes such as experience in coordination management, experience in the international & local engineering standards, experience in design review of the various engineering disciplines, experience in estimation, financial control including payments, experience in project planning & scheduling, experience in the project packaging of the various disciplines, bidding, and awarding and professional experience in project documentation and document control. The construction phase experience category includes factors such as experience in contract management and administration, experience in safety management, experience in environment protection management, experience in procurement management, experience in risk management, experience in change management, experience in disputes prevention and disputes management, experience in data management, experience in site management and experience in sub-contracts management.

### **GENERAL CONTRACTING FACTORS**

In addition to the general company and construction management factors, the general contracting factors group focuses on the performance of the CM@R company as a general construction contractor. As mentioned earlier, the CM&R company performs dual tasks: construction management and general contracting. The first category is the key staff and personnel. The factors in this group are similar to the factors found in evaluating general contractors using the traditional delivery method. This includes total number of people, used exclusively in construction services, proposed number of purely construction office-staff will work on the project, proposed number of purely construction site-staff will work on the project site, key staff personnel qualification background, experience, and the organization structure of the project site team.

The general contracting experience category includes factors such as total construction volume in dollars that the organization has performed as only construction contracting firm (GC), company experience of similar construction work and/or work package(s) and the number and value of the currently undertaken projects in which firm is performing only construction contracting services. The subcontracting category includes the main contractor subcontracting strategy (subcontracting a great percentage of the project) and the contractor willingness to carry out the project in joint venture with another contractor(s).

The construction resources category includes physical resources of the main contractor at the project site, human resources of the contractor at the project site, quality and quantity of the contractor physical resources on site, suitability of the contractor's equipment at the project site and ownership of the physical resources and equipment. The construction methods category includes contractor presentation of innovative ideas to be implemented, contractor technical approach and constraints for the project and contractor construction strategy for the project.

## **5. PROPOSED SELECTION FRAMEWORK**

A selection framework is proposed in this section. This framework can be used by owners to evaluate the construction management at risk companies and select the appropriate one. The framework consists of the following steps:

1. Identify and determine the selection factors (SF) that affect the evaluation of construction management at risk contractor's bids. The selection factors (SF) are the most primary significant factors that attract skilled evaluator, owners and/or consultant while evaluating and selecting the winning bid. Those factors can reflect bidder intent and his/her efficiency to be awarded. Those factors can be categorized into broad categories (CT), and into more general groups (GP) that compose the bid. A comprehensive list of selection factors (SF) were presented in the previous section.

2. Determine the weights of the selection factors (SFW) for each category, the weight of each category (CTW) for each group and the weight of each group (GPW) for CM@R bids.
3. Develop a five grade scale to determine a selection factor score (SFS). This scale is a main tool in this framework as it allows the evaluator of a bid to assess and assign scores for each of the selection factors for the evaluated bid. The given score reflects the response of the bid to the project requirements.
4. Calculate the score for each category (CT) using Equation 1.

$$CTS = \sum_i^n SFS_i * SFW_i \dots\dots\dots\text{Equation 1}$$

where:

- CTS: Category Score
- SFS: Selection Factor Score
- SFW: Selection Factor Weight
- n: Number of selection factors within the category
- i: Selection Factor number

5. Calculate the score for each group (GP) using Equation 2.

$$GPS = \sum_i^n CTS_i * CTW_i \dots\dots\dots\text{Equation 2}$$

where:

- GPS: Group Score
- CTS: Category Score
- CTW: Category Weight
- n: Number of categories within the group
- i: category number

6. Calculate the final bid score (BD) using Equation 3.

$$BDS = \sum_i^n GPS_i * GPW_i \dots\dots\dots\text{Equation 3}$$

where:

- BDS: Bid Score
- GPS: Group Score
- GPW: Group Weight
- n: Number of groups (3)
- i: Group number

7. Choose the construction management at risk contractor with the highest bid score.

## 6. CONCLUSIONS

A client selects a general contractor / construction manager to provide CM at Risk services based on qualifications and makes the construction manager a member of a collaborative project team during design. When construction begins, the construction manager provides a bonded Guaranteed Maximum Price. The owner solicits proposals from a selected group of CM firms and checks their work history, the qualification of their staff, their system approaches, and experience with similar projects and proposed management structure. The owner selects the general contractor / construction manager based on qualification, references, and perceived “best value”.

This paper presents the first step in developing a selection model that assists owners to choose the best construction management at risk contractor. A comprehensive list of factors that guide in the decision making is

developed. The factors list takes into consideration the unique features of this method as the selected contractor will perform two types of services which are construction management and general contracting. This paper also proposes a framework to assist owners in selecting the appropriate construction management at risk company.

Owners may use these factors as a guideline in selecting the appropriate construction management at risk contractor. This helps the owner to avoid the uncertainty of the evaluation results, through using a custom made evaluation model that considers all the factors and characteristics of the construction management at risk delivery method. Also, it helps achieve the best “value for money” by choosing an appropriate contractor to carry out the project. In addition, this method will minimize the owner’s risk.

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