

**A Handbook for Improving Real Estate Project Delivery in Malaysia:  
Analysis, Comparison and Selecting the Best Method**

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Submitted to the Department of Architecture  
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**Abstract**

The real estate and construction sectors are very important and integral part of the Malaysian economy. At a macro-level, governmental development plans in Malaysia are based on successive five year plans since 1956. For each of the five year plans, the real estate and construction sectors feature prominently in terms of value and policy implementation. The budget for the five year plans is in relation to public sector expenditure and does not include private sector initiatives. As regards real estate project delivery methods in Malaysia, the most common form is the traditional design-bid-build method. The design-build method is getting some acceptance of late, whereas infrastructure projects do adopt the build-operate-transfer method.

This thesis seeks to classify, analyze and compare the various types of delivery methods and thereafter examine whether there is a methodology for selecting the best delivery method in Malaysia. Each delivery method, apart from actual project delivery itself, entails different apportionment of project risks between the owner and contractor. Choosing the right delivery method can lead to project success, whereas selecting the wrong delivery method invariably leads to project failure.

For the private sector in Malaysia, the owner can pretty much choose the most commercially viable project delivery method. However, for the public sector, there are political and policy considerations, and rules and regulations which may affect the choice of project delivery method.

As a developing country, there is much that Malaysia can learn from the US and other developed countries which are more advanced and experienced in terms of project delivery methods, construction and engineering.

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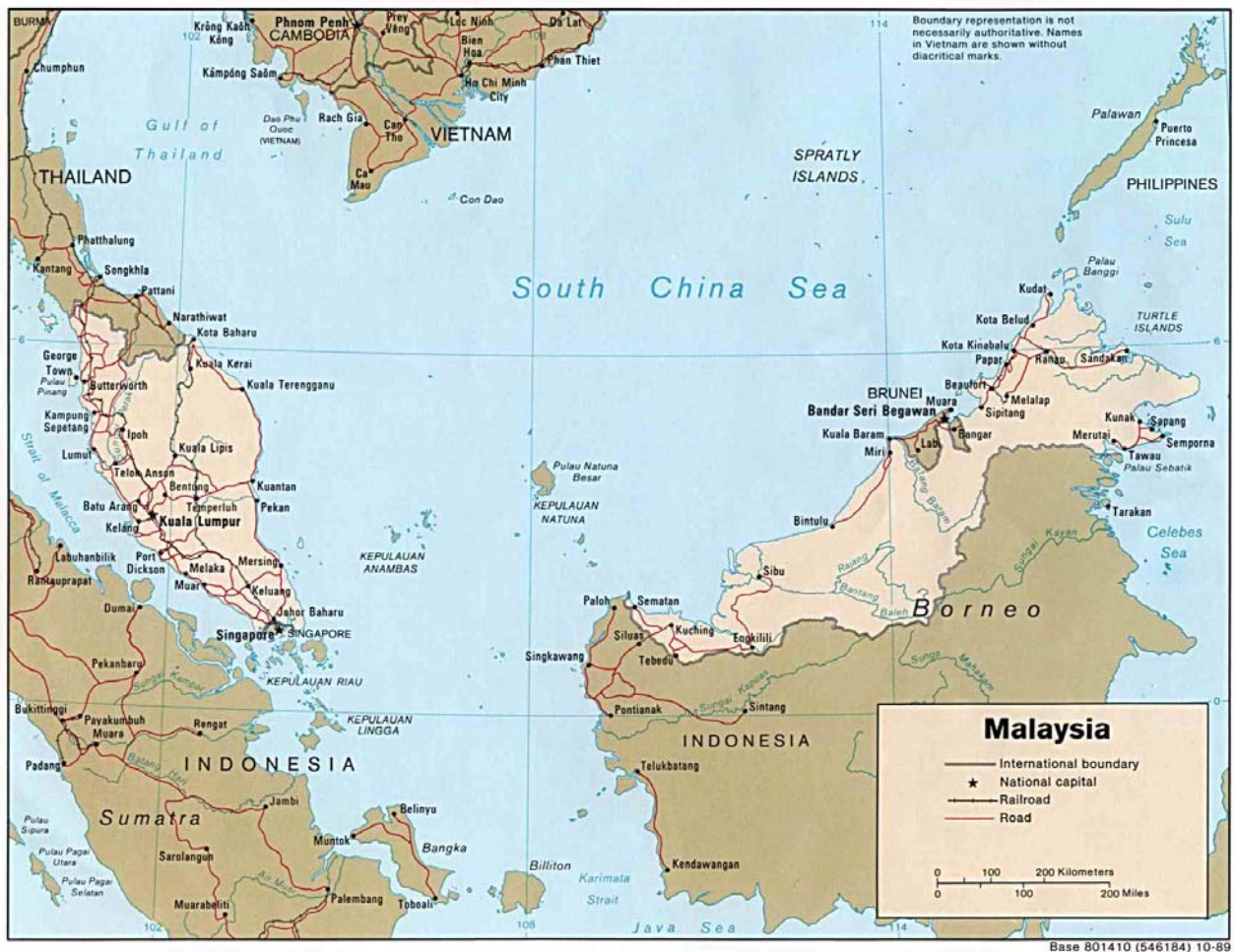
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# Chapter 1 Overview of Malaysia's Country Profile and its Real Estate and Construction Sectors

## 1.1 Geography and Population



Location Map of Malaysia<sup>1</sup>

Malaysia is a tropical country in Southeast Asia located just above the equator with temperatures ranging from 22-33°C and land area totaling 330,113 sq km. The country is comprised of thirteen states and three federal territories.

<sup>1</sup> [http://www.lib.utexas.edu/maps/middle\\_east\\_and\\_asia/malaysia\\_pol\\_1998.pdf](http://www.lib.utexas.edu/maps/middle_east_and_asia/malaysia_pol_1998.pdf)

Malaysia is a multi-racial country with the Malays (and other indigenous groups), Chinese and Indians forming the three major racial groups representing 60%, 24% and 8% of the population respectively. The current population stands at 26.7 million people and is projected to grow at about 2.1% per annum over the next five years. However, the growth rates of the different ethnic group differ. For the period 2001-04, the annual average rates of growth of the *bumiputera* (“sons of the soil”, ethnic Malays and other indigenous peoples), Chinese and Indian communities were 2.2%, 1.2% and 1.6% respectively<sup>2</sup>.

The country’s official language is Malay, while English is widely used for business communication. Mandarin and Chinese dialects are widely spoken among the Chinese population, whereas Tamil is commonly used among the Indians. Islam is the official religion while other religions are free to be practiced.

## **1.2 Politics, Religions and Culture**

Since independence in 1957, the country has been governed by coalition governments headed by United Malays National Organization (UMNO), Malaysian Chinese Association (MCA) and Malaysian Indian Congress (MIC), each representing the Malays, Chinese and Indians respectively. Since 1957, the Prime Minister has come from UMNO, the dominant party in the coalition. By and large, racial harmony has been maintained through this power sharing mechanism.

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<sup>2</sup> Economist Intelligence Report, 2005



Key political themes of the country include racial harmony, positive discrimination in favor of the *bumiputera* (“sons of the soil”- ethnic Malays and other indigenous peoples), the role of Islam in the government and society, religious freedom, economic development and creation of a civil society. Although Islam is the official religion, freedom to practice other religions is enshrined in the country’s constitution. Racial harmony, however, is not to be taken for granted as the country did experience racial riots in 1969.

Malaysia is a parliamentary democracy with the government consisting of three separate branches: the parliament, executive and judiciary. The supreme law of the country is premised on the constitution from which other laws are derived. Malaysia is a federal state with constitutional monarchy. The position of the King is rotated every five years and is chosen from among the nine-member Conference of Rulers.

### **1.3 Economy**

Malaysia has an overall vision to achieve a developed country status by year 2020. Successive governments have made it a key mission to galvanize the people towards this Vision 2020.

Over the past thirty years, Malaysia has seen rapid industrialization, transforming itself from a largely agrarian economy into one increasingly dominated by the manufacturing and services sectors. In 2004, manufacturing and services accounted for 31.4% and 47.1% of the GDP respectively. On the other hand, agricultural accounted for 9.5% of the GDP in 2004.

Manufactures now account for 85% of gross export earnings with electronic goods being the single most important category. In 2004 Malaysia's total exports of goods and services were equivalent to 121% of GDP, a high figure by international standards.

Malaysia, however, is still a major exporter in commodities such as palm oil, rubber, timber and tin. In 2004, Malaysia produces 14 million tons of palm oil, 1.2 million tons of rubber, 33 million tons of cocoa and 22 million cu meters of saw logs. In addition, Malaysia produces about 762,000 barrels of petroleum per day in 2004. [US\$ 1 = RM (Ringgit Malaysia) 3.655].<sup>3</sup> In 1990, Malaysia ranked sixteenth largest in the world in terms of reserves of natural gas, totaling 10.1 billion barrels of oil-equivalents<sup>4</sup> and as of January 1, 2006, Malaysia ranked 13<sup>th</sup> in this category.<sup>5</sup>

The principal exports for 2004 are electronics and electrical machinery (US\$67.6 bn), petroleum and liquefied natural gas (US\$7.3 bn), chemicals and chemical products (US\$7.3 bn), palm oil (US\$5.3 bn) and textiles, clothing and footwear (US\$2.7 bn). The principal imports for 2004 are intermediate goods (US\$75.6 bn), capital goods (US\$14.6 bn), consumption goods (US\$6.1 bn), dual-use goods (US\$2.5 bn) and re-exports (US\$4.5 bn). Malaysia's main trading partners are US, Singapore, Japan, China, Hong Kong and Thailand.

As a developing country, Malaysia can be considered moderately wealthy. Its per capita income in 2005 is Ringgit Malaysia (RM) 18,106 [US\$4,781] and is expected to reach US\$5,145 in

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<sup>3</sup> <http://biz.thestar.com.my/business/exchange.asp>, The Star Newspapers, July 19, 2006

<sup>4</sup> Vincent, Jeffrey R. and Mohamed Ali, Razali, Managing Natural Wealth: Environment and Development in Malaysia, Resources for the Future, 2005, p 103

<sup>5</sup> [http://www.eia.doe.gov/oiaf/ieo/pdf/nat\\_gas.pdf](http://www.eia.doe.gov/oiaf/ieo/pdf/nat_gas.pdf)

2006. In terms of PPP, Malaysia's per capita income in 2004 is US\$10,690. The Real GDP expanded by 5.3% in 2005. The projected growth rate for 2006 is 4.8-6%.<sup>6</sup>

Overall, Malaysia is a dynamic<sup>7</sup> developing country which can use its multi-racial and multi-religious population to its advantage while maintaining and enhancing government institutions which had served the country well.

#### **1.4 Financial Services**

The financial sector in Malaysia is well-developed. After the 1997-1998 financial crisis, the local banking sector was consolidated from seventy-one institutions to ten local banks to enhance competitiveness and viability. The consolidation process is still on-going. As at December 31, 2005, there are ten local banks, thirteen foreign banks and six Islamic banks operating in Malaysia.<sup>8</sup>

Parallel to the existing banking system is a relatively well established Islamic banking sector which is growing in popularity. In 2004, the Islamic banking sector accounted for 10.5% of banking assets and 11.2% of deposits.

In 1998, currency controls were imposed amidst the Asian economic and currency crisis. The controls had since been partially lifted.

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<sup>6</sup> Bank Negara Annual Report, 2005

<sup>7</sup> "There seems a parallel to Germany in the sixties. A still unbroken faith in progress." This quote was made by a German Study Group who toured Malaysia in 1988 when observing the dynamism in Penang, Malaysia. (See Malaysia: Housing and Urban Development, Architecture Department, Technische Hochschule Darmstadt, Germany, Prof Arnold Koerte, Rita Mrotzek-Sampat, Klaus Erzigkeit, 1988.

<sup>8</sup> Bank Negara Annual Report, 2005, Annex, 16

## 1.5 Real Estate and Construction Sectors

The two main drivers in the real estate and construction sectors are housing and infrastructure development.

Over the past thirty years, Malaysia has seen a huge number of new houses being built by both the public and private sector with the former concentrating on low cost housing. In 2001-2005, 844,043 new units were built of which 655,374 were built by private developers.<sup>9</sup> For 2006-2010, 709,400 new units are projected to be built.

On the residential front, more than 130,000 residential units came on stream in the first nine months of 2005, bringing the total stock to 3.59 million units. The Malaysian House Price Index (MHPI) registered a moderate increase of 1.7% in the first half of 2005 and 4.8% in 2004. The yearly increases in the MHPI for 2000-2005 range from 1% in 2001 to 6% in 2000. There is still a moderate residential property overhang of 17,179 units with a total value of RM2.3 billion as at September 2005. 71.5% of these overhang properties are priced at RM150,000 and below.

Overall, the country has seen gradual recovery in the real estate sector from the 1997-1998 financial crisis. At September 2005, the overall occupancy rates for office and retail sector were 83.8% and 79.6% respectively. In 2005, the average monthly rentals for prime office and retail space were RM48 per sq meter and RM254 per sq meter respectively.

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<sup>9</sup> 9<sup>th</sup> Malaysia Plan, p 439

In terms of infrastructure, the country has from the 1990s through to the 21<sup>st</sup> century embarked on many huge infrastructure projects which include Putrajaya (Malaysia's RM30 bn new administrative centre), Petronas Twin Towers (once the world's tallest buildings), Kuala Lumpur International Airport, Light Rapid Transit in Kuala Lumpur and the Bakun Hydroelectric Dam in Sarawak.

In addition to the above, there were highways, roads, bridges, power plants, hospitals, schools, railroads and other water and utilities infrastructure. In 2004, the construction sector employed 798,000 workers which formed 7.6% of the total workforce. As part of the Ninth Malaysia Plan (for the period 2006-2010), the Malaysian government announced on July 20, 2006 that 880 initial projects worth RM15 bn will begin to be tendered out in three months.<sup>10</sup>

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<sup>10</sup> <http://thestar.com.my/news/story.asp?file=/2006/7/20/nation/14892755&sec=nation>

## Chapter 2 The Six Main Project Delivery Methods and Their Commonalities

The various methods of project delivery can be classified under six main categories:

(i) Multiple Prime Contracting (ii) General Contractor (iii) Construction Management (iv) Design-Build (v) Turnkey (vi) Build-Operate-Transfer (Gordon 1994)<sup>11</sup>. Further, there are hybrid delivery methods which may fall under two or more categories of project delivery methods.

The traditional project delivery method is the design-bid-build method. Any project delivery method that varies from the traditional design-bid-build method can be described as an alternative delivery method.<sup>12</sup> The construction management delivery method can be in the traditional project delivery mode or alternative delivery mode depending on how the contract is structured.

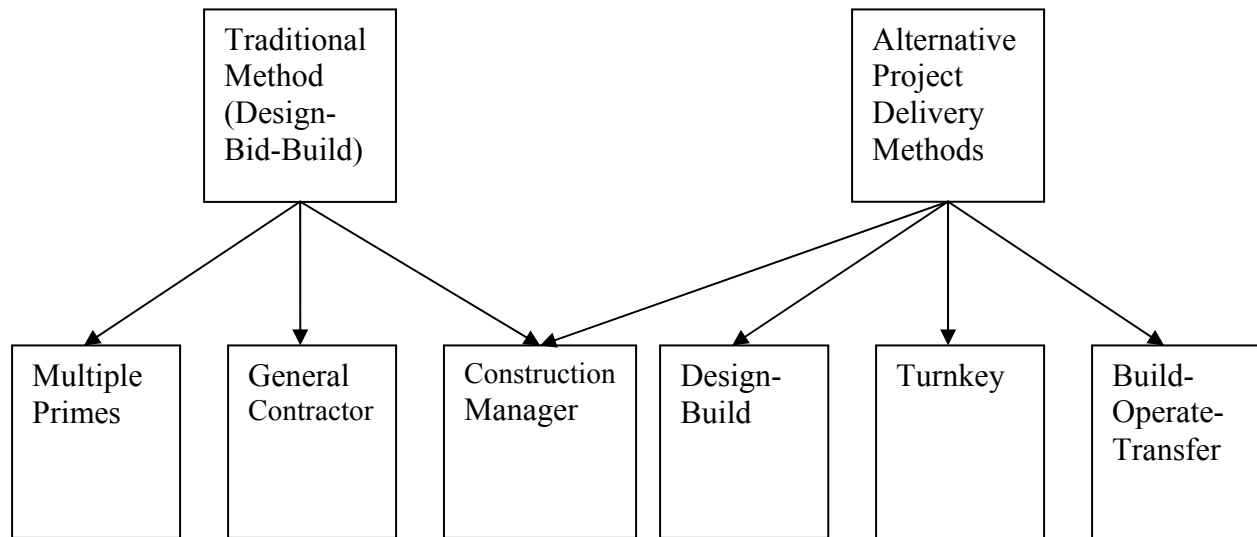
The following chart shows a simplified delineation of the traditional project delivery method and the alternative delivery methods.

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<sup>11</sup> Gordon, Chris M, Choosing Appropriate Construction Contracting Method, Journal of Construction Engineering, American Society of Civil Engineers, Vol 120, Mar 1994, 206

<sup>12</sup> White, Nancy J., Principles and Practices of Construction Law, Prentice Hall, 2002, 411



**Figure 1: Traditional Project Delivery Method vs. Alternative Delivery Methods**

According to John Macomber (Macomber 1989), there are essentially seven key areas in analyzing and managing construction risk: (1) Types and phases of risk (2) Assessment of the project risk (3) Matching risks with in-house capability and organizing a construction team (4) Defining a building strategy (5) Choosing the right kind of contract (6) Choosing the builder (7) Monitoring Construction.<sup>13</sup> Each delivery method through the appropriate contract, apart from actual project delivery itself, attracts different apportionment of project risks between the owner and contractor<sup>14</sup>. Risk management is like preventive medicine<sup>15</sup> and there is wisdom in the saying “prevention is better than cure”.

<sup>13</sup> Macomber, John D, Harvard Business Review, March-April 1989, p 157

<sup>14</sup> Rubin, Robert A., Journal of Management in Engineering, November/December 1998, p 36

<sup>15</sup> Papageorge, Thomas E., Risk Management for Building Professionals, R.S. Means Company, Inc., 1988, p ix.

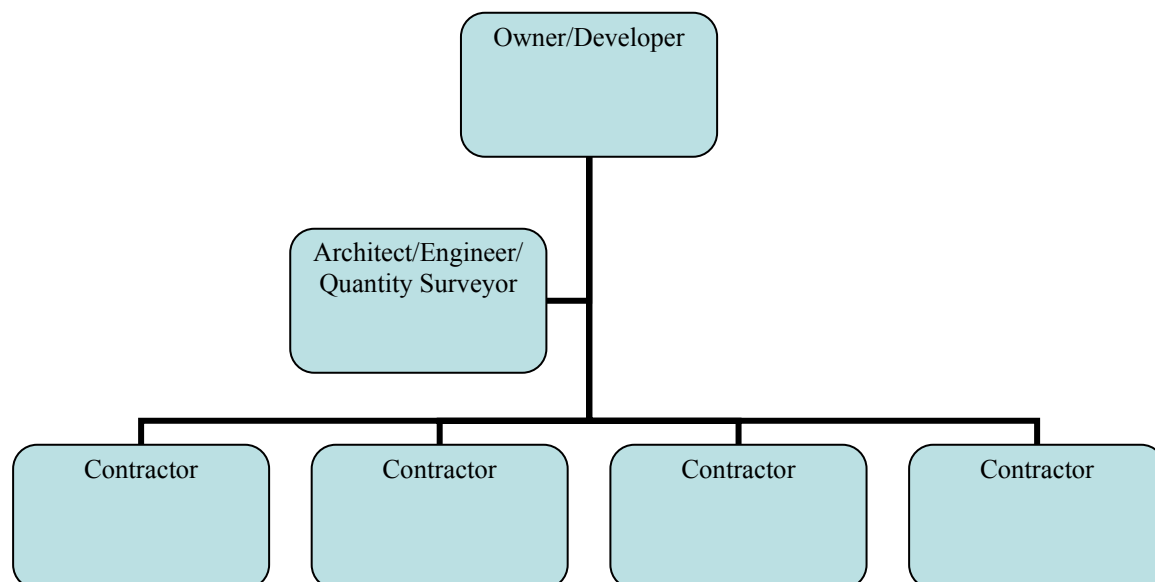
Various studies had been conducted in attempts to use hedonic models as predictive tools for project selection and performance from the owners' perspective.<sup>16</sup> The results of these studies have been mixed in that construction projects, like real estate, are heterogeneous. No two construction projects are alike as they differ in terms of site, players and project attributes.

## 2.1 Multiple Prime Contracting

### 2.1.1 Description of method

In this mode of project delivery, the developer appoints directly the various contractors to do the whole range of works which include piling, foundation, basements, car park structures, main tower structure, formworks, lifts, roofing, landscaping and interior works (such as tiling, plumbing, electrical, painting, doors and frames).

### 2.1.2 Organization Structure



**Figure 2: Multiple Prime Contracting Method**

<sup>16</sup> Ling, Florence Y. and others, Predicting Performance of Design-Build and Design-Bid-Build Projects, Journal of Construction Engineering and Management, ACSE, Jan-Feb 2004.



### **2.1.3 Advantages and Disadvantages**

#### **Advantages of the Multiple Prime Contracting Method**

- (i) The communication between the owner and each prime contractor is faster and more direct in view of their direct contractual relationship.
- (ii) There is a possibility for fast-tracking as the owner is in control of both the design (with the assistance of the architect) and the actual construction. These two tasks may be performed simultaneously where the initial stages of design had been completed.
- (iii) There is a greater leeway for changes in design and specifications as the owner controls the contracting functions with the various contractors
- (iv) The owner has better access to market information due to the direct relationship with the various prime contractors.
- (v) This method improves the owner company's construction knowledge DNA.

#### **Disadvantages of the Multiple Prime Contracting Method**

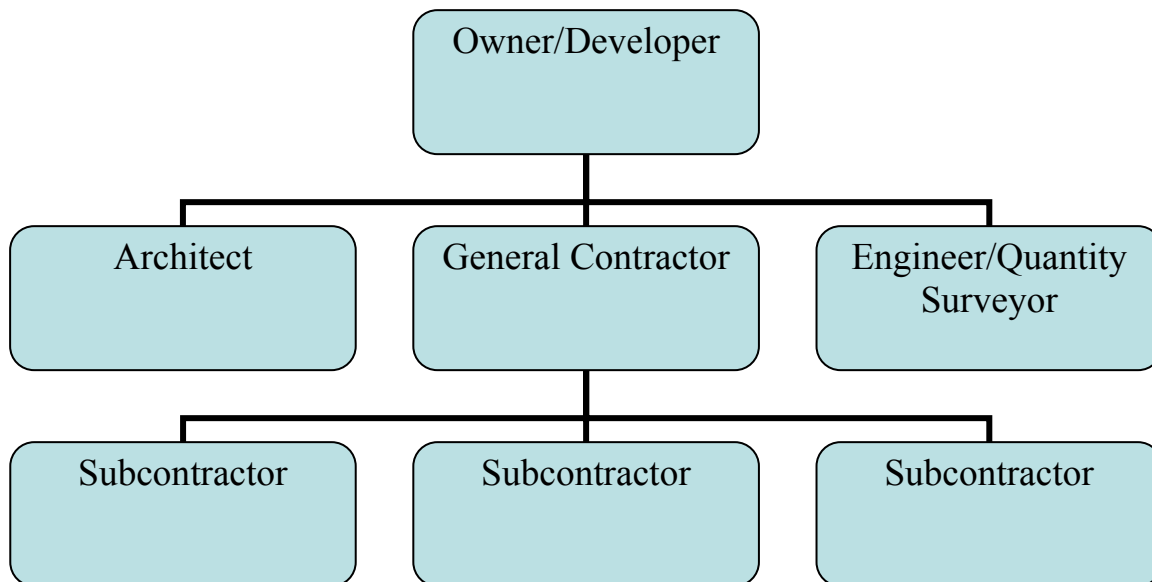
- (i) The owner needs to be very knowledgeable in construction in terms of constructability, construction scheduling and contracts administration.
- (ii) There is no pre-construction advice from contractors.
- (iii) The owner's administrative resources may be stretched due to the hands-on nature of this project delivery method.
- (iv) There is no general contractor to share the risks of the project.

## 2.2 General Contractor

### 2.2.1 Description of method

In the general contractor method, the owner/developer contracts with only one main general contractor. The general contractor in turn subcontracts parcels of the works to other subcontractors<sup>17</sup>. In this case, the design professional usually contracts as an agent for the owner and assists with the contracts administration of the project. The format for this form of contracting is the design-bid-build method. In Malaysia, the general contractor is also commonly known as the main contractor.

### 2.2.2 Organization Structure



**Figure 3: General Contractor Method**

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<sup>17</sup> In the US, subcontractors are often known as specialist contractors or specialist trade-contractors.

### **2.2.3 Advantages and Disadvantages**

#### **Advantages of the General Contractor Method**

- (i) The owner has the benefit of the architect's advice on design and role in contracts administration.
- (ii) The owner controls the design vicariously through the architect via a direct contractual relationship.
- (iii) Cost and time can be controlled if the designs are clear and complete and the competent general contractor is well briefed on the designs.
- (iv) This traditional form is a well-known method to owners, designers and contractors.<sup>18</sup> Hence, there is the accrued benefit of familiarity of practice and a shorter learning curve.

#### **Disadvantages of the General Contractor Method**

- (i) In principle, the design has to be completed before bidding and construction can only begin after the design and subsequent award of the contract. This can prolong the period from inception to completion.
- (ii) The separation of design and construction functions can lead to miscommunication and misalignment of interest between the owner/designer and the contractor.
- (iii) Disputes as to designs, drawings, variations, payment certificates and specifications can cause time and cost overruns.
- (iv) Changes in design once construction has begun can have severe time and cost implications.

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<sup>18</sup> Gould, Frederick E. and Joyce, Nancy E., Construction Project Management, Prentice Hall, 2003, p 101

## 2.3 Construction Management

### 2.3.1 Description of Method

Construction Management surfaced in the US in the early 1960s as a new contracting method for large commercial development projects. According to Keith Collier (Collier 1994), the main purposes of construction management then (and now) are: (1) employing the best managers available, (2) reducing project time and financing cost and (3) creating a flexible method of construction that leaves as much control as possible with the owner-developer.<sup>19</sup> In any event, selection of the construction manager is no less important than selecting the contractor, with emphasis on his experience, expertise, competence, track-record, manpower and financial standing<sup>20</sup>.

The Construction Management Association of America has the following definitions of construction management:

- (i) A professional service that applies effective management techniques to the planning, design and construction of a project from inception to completion
- (ii) A committed purpose in controlling time, cost and quality
- (iii) A service that assists the owner to pay close, continuing attention to every detail, some of which can "make or break" a project
- (iv) A service to assist the owner's staff with pre-planning, design, construction, engineering and management expertise across project delivery methods.<sup>21</sup>

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<sup>19</sup> Collier, Keith, *Managing Construction: The Contractual Viewpoint*, Delmar Publishers Inc, 1994, p 35

<sup>20</sup> Barrie, Donald S. and Paulson, Boyd C., *Professional Construction Management*, McGraw-Hill Inc., 1992, p 159

<sup>21</sup> [http://cmaanet.org/cm\\_is.php](http://cmaanet.org/cm_is.php), Construction Management Association of America (CMAA)'s website

Essentially, the construction management method involves hiring a construction manager who is expert in construction. There are two principle ways in which the construction manager is hired: as agent (CM – Agency) or at-risk (CM @ Risk).<sup>22</sup>

Under the construction manager as agent method, the construction manager offers his services as an agent for a fee. He does not share the success or failure in the project.

In the case of construction manager at risk, the construction manager assumes the risk of the general contractor with a Guaranteed Maximum Price (GMP). He may be the general contractor himself or engage one at his own discretion.

One school of thought favors the CM-Agency method. A key proponent of this pure form of construction management is John L. Tishman (Tishman 1998).<sup>23</sup> The key argument in favor of CM-Agency is the strong alignment of interest between the owner and the construction manager. On the other hand, there are others who favor the CM @ Risk method in that it allocates some risk to the construction manager through the Guaranteed Maximum Price. However, in troubled times, CM @ Risk may bear the same resemblance of owner-contractor tension of the general contracting method.

A summary of the key differences between CM-Agency and CM @ Risk is as described in the table below.

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<sup>22</sup> Ibid. CMAA

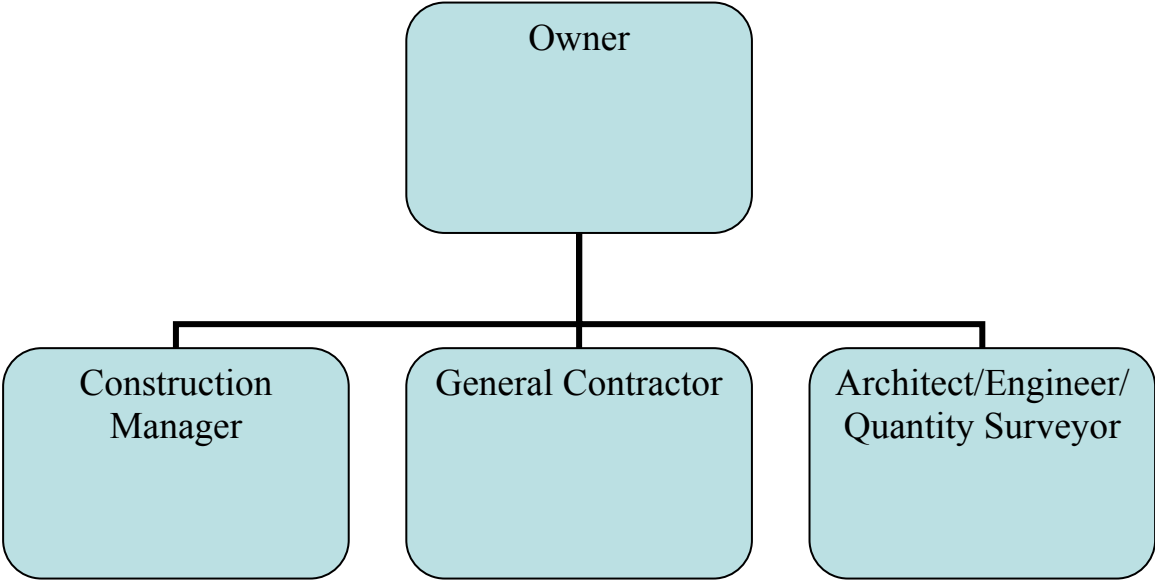
<sup>23</sup> Tishman, John L., The Robert B. Harris Inaugural Lecture, The Center for Construction Engineering and Management, The University of Michigan, 1988.

<b>CM-Agency</b>	<b>CM @ Risk</b>
Acts as agent for owner	Acts as owner's representative
Does not sign contracts on his own	Signs contracts on his own
Liability to exercise reasonable skill and care as required of construction professionals	Liability in regard to time, cost and specifications in the project
Architect is a co-advisor to the owner	Architect may be a co-advisor to the owner or work for the construction manager, depending on the contract structure
Fee can be fixed or based on a percentage of the project cost	Fee is included in the contract sum or Guaranteed Maximum Price
Strong alignment of interest between construction manager and owner	Relationship may become adversarial if the project runs into hiccups

**Figure 4: Summary of Key Differences between CM-Agency and CM @ Risk**

**2.3.2 Organization Structure**

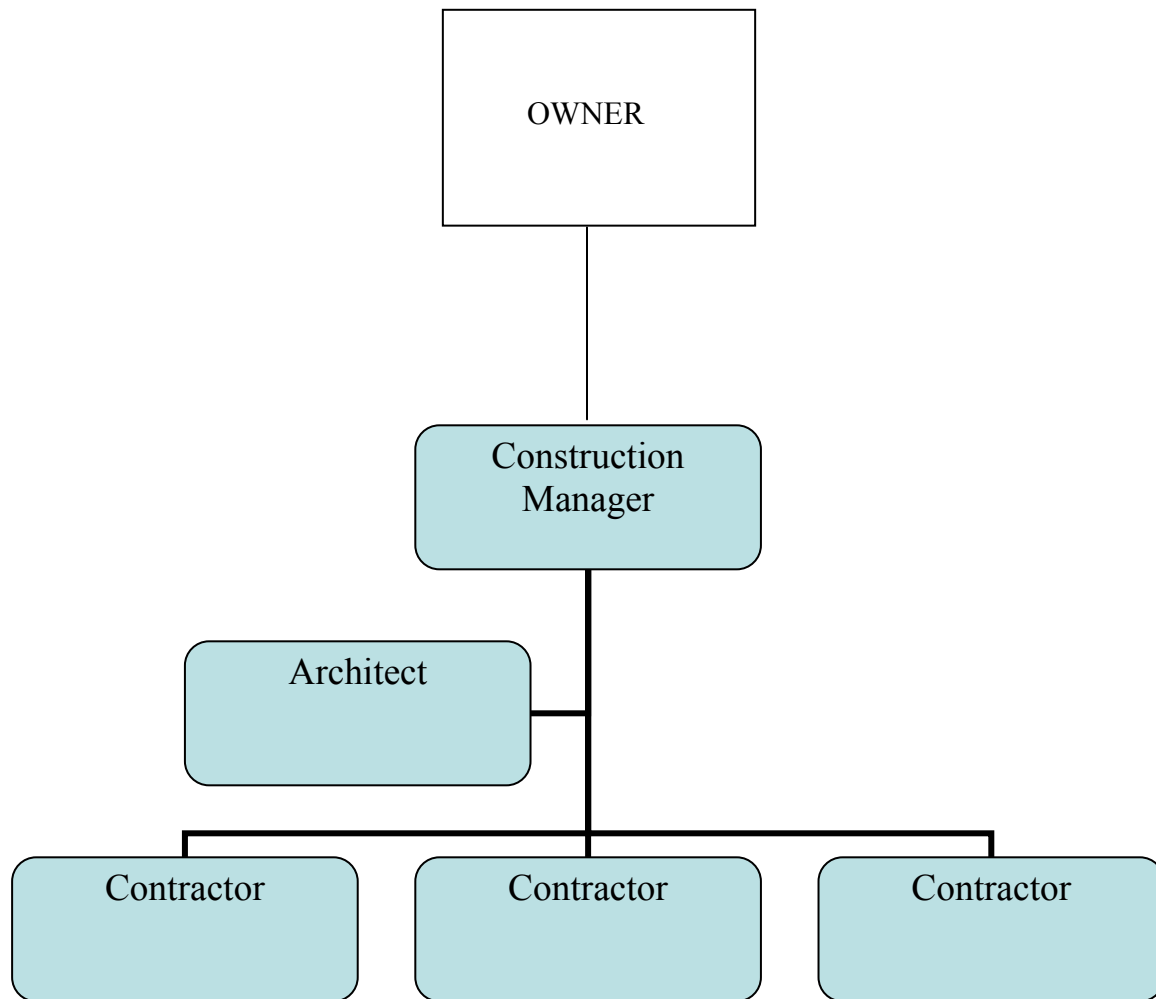
**(i) Construction Manager as Agent**



**Figure 5: Construction Manager as Agent Method**

**(ii) Construction Manager at Risk**

Under this method, the construction manager usually assumes, at some stage in the progress of the works, the risk of a Guaranteed Maximum Price (GMP). By the time the documents and design are about 60-70% complete, they may be submitted to the authority for review and/or approval. Based on these documents and drawings, the construction manager with his knowledge, experience and expertise can come up with a GMP.<sup>24</sup>



**Figure 6: Construction Manager @ Risk Method**

<sup>24</sup> O' Leary, Arthur F., Design Cost Data, Mar-Apr 2006, 10, Article originally written in 1993 for Construction Law Reporter.

The above are two main organization structures of the construction management delivery method. There are actually many variants to these structures. The Committee of Construction Management listed at least twelve 12 different contracting structures to the construction management delivery method.<sup>25</sup>

### **2.3.3 Advantages and Disadvantages**

#### **Advantages of the Construction Management Method**

- (i) The owner has the benefit of pre-construction advice from the construction manager.<sup>26</sup>
- (ii) The owner has pre-design advice from the construction manager to the extent that the construction manager has in-house architects.
- (iii) For large complex project, the expertise of the construction manager can be crucial for project success.
- (iv) By being involved in the project from the beginning to the end, the construction manager is able to interrelate and control all relevant variables to influence cost, time and quality of the project.<sup>27</sup>
- (v) The construction manager has the potential to minimize the owner's time and staff commitment to the project.<sup>28</sup>
- (vi) The early involvement of the construction manager allows for value-engineering.<sup>29</sup>

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<sup>25</sup> Qualifications and Selection of Construction Managers with Suggested Guidelines for Selection Process, Journal of Construction Engineering and Management, 68-69, American Society of Civil Engineers.

<sup>26</sup> Ibid. Tishman, John L.

<sup>27</sup> Tenah, Kwaku A., The Construction Management Process, Reston Publishing Company, Inc, 1985

<sup>28</sup> Ibid.

<sup>29</sup> Op. Cit., Gould, Frederick E. and Joyce, Nancy E., p 108



(vii) The CM – Agency method provides strong alignment of interest between the owner and the construction manager. In other project delivery methods, the relationship between the owner and the contractor can be adversarial.<sup>30</sup>

(viii) Under CM @ Risk, the owner can share some risks with the construction manager through Guaranteed Maximum Price contracting.

(ix) The CM @ Risk method allows for fast-tracking if the construction manager can assume control over the design and construction functions.

### **Disadvantages of the Construction Management Method**

(i) The construction manager is an additional layer to the traditional tripartite players in a project, namely: the owner, designer and contractor. This attracts additional fees.<sup>31</sup>

(ii) For CM-Agency, the construction manager does not have direct contractual relationship with the various contractors and this may in turn reduce his authority in the eyes of the contractors.<sup>32</sup>

(iii) For CM-Agency, the construction manager is not liable for delays and cost overruns. Hence, the perceived strong alignment of interest is a qualified one.

(iv) At times, there may be conflicts between the construction manager and the architect due to their overlapping advisory roles and the lack of direct contractual relation between them.

(v) For CM @ Risk with Guaranteed Maximum Price, the same adversarial relationship between the owner and contractor in the traditional methods may surface when the project runs into trouble.

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<sup>30</sup> Ibid.

<sup>31</sup> Op. Cit., Tenah, Kwaku A.

<sup>32</sup> Ibid.

## **2.4 Design-Build**

### **2.4.1 Description of Method**

In the design-build method<sup>33</sup>, the owner/developer contracts with one contractor who in turn hires the architect, engineer and quantity surveyor for the works. Typically, the owner in consultation with the architect prepares the owner's requirements at least to the extent sufficient for design-build contractors to forward proposals for the owner's acceptance.

Historically, the design-build method is rooted in antiquity. The pyramids, the cathedrals of Europe and other historical monuments were built using the master builder concept which integrated design and construction functions in one master builder.<sup>34</sup> When the building industry becomes more complex, the roles become segregated as between the designer and the builder for greater specialization. However, as the industry becomes even more complex and challenging, effective and efficient communication becomes crucial. Hence, of late, there is a selective re-aggregation of the roles of the designer and builder in the form of the design-build contractor to facilitate communication a la history repeats itself.

With the current trend towards green (with emphasis of environmental friendliness) and lean (with emphasis on minimal wastage) principles of building and construction, it is interesting to note that a study by David Riley and others (Riley 2005) suggests that the design-build method has some advantages over the design-bid-build method for green and sustainable building

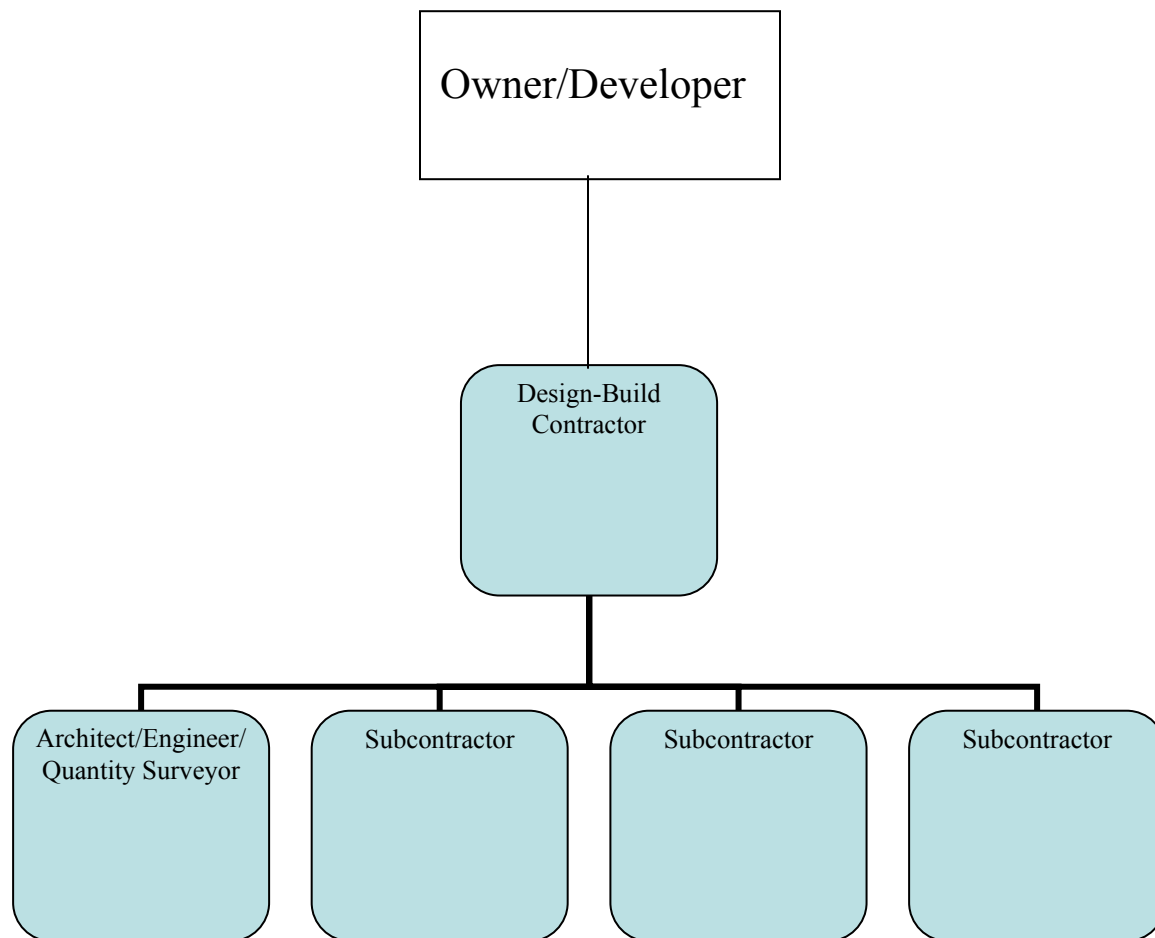
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<sup>33</sup> This project delivery method is widely used for water and wastewater treatment facilities in the US. (See Molenaar, Keith R., Design/Build for Water/Wastewater Facilities: State of the Industry Survey and three Case Studies, Journal of Management in Engineering, ASCE, Jan 2004, p 22.) It is also commonly used for public building sector and highway projects. (See Molenaar, Keith R. and Gransberg, Douglas D., Design-Builder Selection for Small Highway Projects, Journal of Management in Engineering, ASCE, Oct 2001, p 214.)

<sup>34</sup> Emprin-Gilardini, Vincenzo, Master Buillder of the Middle Ages and Design Build of Today: An Analysis and Comparison, MIT SM Thesis, Civil Engineering, 2000, p 9

projects. The main reasons put forward were (1) design-build contractors are more willing to innovate and adopt new technologies (2) integrated design and detailing expertise of design-build contractors contributes to cost and long term energy cost savings and (3) early involvement of design-build contractors adds value to the project, especially where the conditions are challenging.<sup>35</sup>

## 2.4.2 Organization Structure



**Figure 7: Design-Build Method**

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<sup>35</sup> David Riley, Victor Sanvido, Michael Horman, Michael McLaughlin, and Daniel Kerr, Lean and Green: The Role of Design-Build Mechanical Competencies in the Design and Construction of Green Buildings, Construction Research Congress 2005

### **2.4.3 Advantages and Disadvantages**

#### **Advantages of the Design-Build Method**

- (i) There is a single point accountability and responsibility for design and construction<sup>36</sup>.
- (ii) Cost and time overruns from variation orders<sup>37</sup> are usually not an issue.
- (iii) This method allows for fast-tracking as the design and construction responsibilities rest with the contractor who can commence construction when the design is not 100% complete.
- (iv) There is better communication between the contractor and the designer as design responsibility rests with the contractor.<sup>38</sup>

#### **Disadvantages of the Design-Build Method**

- (i) The owner loses design and contracts administration control once the project is awarded.
- (ii) It is very difficult for the owner to implement design changes without attracting severe cost and time overruns once the construction has begun.
- (iii) There is a danger of under-design in which the design-build contractor builds to the minimum in compliance with the owner's requirements and the contractor's proposal.
- (iv) Although the contractor is responsible for both the design and construction, there is a requirement for significant front-loading of design work in order for the contractors to bid and/or submit proposals for successful implementation of the design-build method.

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<sup>36</sup> Brown, Robert P. and Aubin, Mark C., The Risks and Benefits of Design-Build Contracting, Construction Business Review, Vol. 7, No. 4, 1997, p 22

<sup>37</sup> In Malaysia and other Commonwealth countries, change orders are termed as variation orders.

<sup>38</sup> Op. Cit., Gould, Frederick E. and Joyce, Nancy E., p 104

## **2.5 Turnkey**

The turnkey method is similar to the design-build method. One school of opinion defines it to include short-term financing<sup>39</sup> while others define it to include interiors and/or commissioning to the extent that the contractor completes everything whereupon he or she hands over the keys and the owner just needs to turn the keys. This thesis adopts the latter definition. Correspondingly, the description, organization structure and advantages and disadvantages in regard to design-build delivery method in 2.4 above apply mutatis mutandis to the turnkey method.

## **2.6 Build-Operate-Transfer (BOT)**

### **2.6.1 Description of Method**

Under this delivery mode, the contractor designs, finances, builds, operates and transfers the property back to the owner after a certain pre-agreed period.

Arguably, the first BOT project in the modern world is the Suez Canal (Levy 1996).<sup>40</sup>

Construction began in 1859 and the completion date was scheduled for 1864 with a budgeted cost of £8 million. Owing to cost and time overruns, the project was ultimately completed at a total cost of £18 million, ten years later. However, it should be noted that by the first decade of the 20<sup>th</sup> century, Great Britain's investment had increased tenfold in value.

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<sup>39</sup> Gordon, Christopher M., Compatibility of Construction Contracting Methods with Projects and Owners, Thesis CE, 1991 SM

<sup>40</sup> Levy, Sidney M., Build, Operate and Transfer – Paving the Way for Tomorrow's Infrastructure, John Wiley & Sons, Inc., 1996. pp 19-20.

The BOT project delivery method has many variants including:

BOO – Build, Own, Operate (without obligation to transfer)<sup>41</sup>

BTO – Build, Transfer, Operate<sup>42</sup>

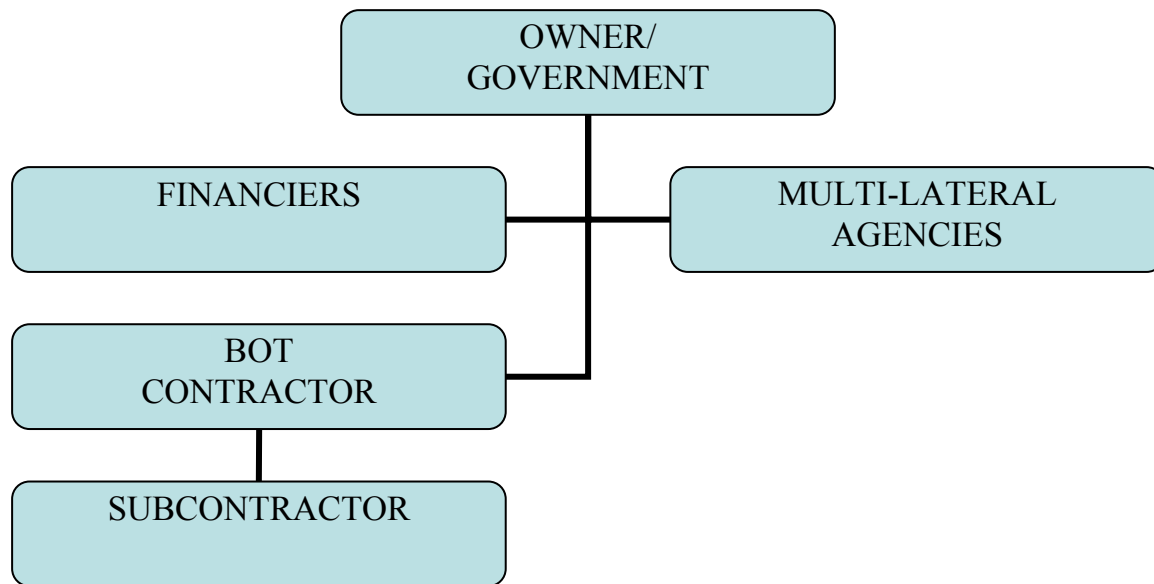
BRT – Build, Rent, Transfer<sup>43</sup>

BOOST – Build, Own, Operate, Subsidize, Transfer<sup>44</sup>

BOMT – Build, Operate, Maintain, Transfer.

The BOT method is particularly suited for infrastructure projects, though not exclusively so. If properly structured, BOT can be used for hotels, resorts, golf courses, brownfield development and other projects

### 2.6.2 Organization Structure



**Figure 8: Build-Operate-Transfer Method**

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<sup>41</sup> Ibid.

<sup>42</sup> Ibid.

<sup>43</sup> Ibid.

<sup>44</sup> Ibid.

There are many ways in which a BOT project delivery method can be structured, much of which depends on the manner the project is financed and how the cash-flows are streamed.

### **2.6.3 Advantages and Disadvantages**

#### **Advantages of the Build-Operate-Transfer Method**

- (i) BOT allows for infrastructure to be built where the government or owner is unable to finance the project.<sup>45</sup>
- (ii) The government or owner incurs very little or no risk as the project is financed usually multilaterally through contractor's equity, international agencies and financial institutions.<sup>46</sup>
- (iii) Since it is a private sector operation, it is normally more efficient as the construction and operations are conducted without the government's bureaucratic machinery.<sup>47</sup>
- (iv) Since the BOT contractor often operates the facility for twenty years or more to collect the required returns, the incentive for initial quality delivery is high<sup>48</sup>.
- (v) For developing countries, BOT allows for technology transfer in terms of construction technology, maintenance and operations.
- (vi) Private firms are usually more innovative in the design and operation phases of the project.<sup>49</sup>

#### **Disadvantages of the Build-Operate-Transfer Method**

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<sup>45</sup> Ibid.

<sup>46</sup> Ibid.

<sup>47</sup> Ibid.

<sup>48</sup> Ibid.

<sup>49</sup> Liddle, Brantley T., Journal of Management Engineering, May-June 1997, p 73.

(i) BOT can cause political problems if the interests of the government, citizenry and contractor are not aligned.

(ii) The owner has little control over the design and construction of the project.

(iii) In view of the size of BOT projects, cost overrun may grind the project to a halt, given the complex financing structure which usually accompanies BOT projects.<sup>50</sup>

(iv) In view of the long duration of the BOT contract, changes in exchange rates, demographics and technology can severely affect revenues and interests of both the contractor and the owner.

This added risk is likely to be priced in the BOT arrangement by the contractor

(v) The incentives and revenue collection accorded by the government to the BOT contractor may end up being more costly to taxpayers.<sup>51</sup>

## **2.7 Commonalities among the Six Main Delivery Methods**

Whilst the above delivery methods are different approaches to project delivery, they are not without commonalities.

### **2.7.1 Award System**

For each of the above delivery method, the contract can be awarded to the contractor through open bidding or through negotiation between the parties. In the open-bid process, it can be further sub-divided into two categories: (i) open to public and (ii) by invitation only.

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<sup>50</sup> Op. Cit., Levy, Sidney M.

<sup>51</sup> Ibid, 401.



The above award systems are found both in the public and private sectors. Bidding can be an expensive endeavor for the contractor, more so in design-build than design-bid-build. Hence, it is not uncommon that design-build contractors sometimes get partial reimbursement for their bidding effort by prior agreement.

The tendering process can be a straight-forward “one tender” affair but it can also be complicated through first tender, re-tender and final tender.<sup>52</sup>

For public sector projects, the open bidding system is generally recommended for greater transparency, accountability and good governance. For private sector initiatives, projects are sometimes awarded through negotiation which can also be effective if the contractor is a trusted entity with an excellent track record.

### **2.7.2 Contracting Principles**

All the six main delivery methods are premised on the “independent subcontractor” concept except for pure agency construction management delivery method. The independent subcontractor concept necessitates that the subcontractor is free to use his construction expertise in accordance with the contract. Hence, the construction methods are essentially his territory except otherwise provided. However, the contractor does not represent the owner’s interests. On the other hand, in the case of the pure agency construction management delivery method, the construction manager acts as an agent for the owner. In principle, the owner is responsible for the

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<sup>52</sup> Management of International Construction Contracts, Thomas Telford London, 1985,133: Article by Duncan A. on his experience in Malaysia.

actions of the construction manager insofar as they relate to the project and the construction manager acts as an agent within the authority delegated to him.

### **2.7.3 Mode of Remuneration**

The mode of remuneration for each of the delivery method can be:

#### **(i) Fixed Price/Lump Sum**

This mode of remuneration is based on an agreement where the contractor charges for specific works for a fixed sum based on contractual documents, drawings and bills of quantities.<sup>53</sup>

Ideally, in a lump sum contract, there should be no problem of time and cost overruns. In reality, there are often many disputes on specifications, drawings (with differing interpretations of what is required), variations, extensions of time needed and certificates of payments.

For CM – Agency, it can be based on a fixed fee. Strictly speaking, the CM – Agency’s role is that of an advisor and not a contractor.

#### **(ii) Cost Plus Fee or Percentage<sup>54</sup>**

This mode is sometimes called the reimbursable contract as it is based on the contractor being reimbursed the cost plus either a fixed fee or percentage of the cost.

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<sup>53</sup> Elliott, Robert F., *Building Contract Disputes: Practice and Precedents*, Sweet & Maxwell Limited, 1998, p 1-37

<sup>54</sup> Clough, Richard H. and Sears, Glenn A., *Construction Contracting*, John Wiley & Sons. Inc., 1994, p 139

The main advantage of this mode of payment is that the owner can effect changes without attracting severe time and cost implications. On the other hand, the main disadvantage would be that the contractor may not be motivated to be efficient as he is paid more as the cost increases. Additionally, he may not assign the best staff to the job.

**(iii) Unit Price<sup>55</sup>**

This mode provides that the contractor be paid on a pre-agreed price per unit of components of the works. The contractor is required to incorporate his cost, overheads and profits into the unit prices.

The main advantage of this mode of payment is similar to that of a cost plus contract in the sense that owner can effect changes without attracting severe time and cost implications.

Correspondingly, the main disadvantage would be that the contractor may not be motivated to be efficient as he is paid more as more units are constructed. Additionally, he may not assign the best staff to the job.

**(iv) A Combination of the above three modes.**

Depending on the requirements of the owner, a contract which combines the above three modes of payment can be effected.

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<sup>55</sup> Op. Cit., Gould, Frederick E. and Joyce, Nancy E., p 111.

## **Chapter 2 Appendix: Other Alternative Delivery Methods**

There are other alternative delivery methods which are not classified as one of the six main delivery methods in this thesis. Examples of such methods are included in 2A.1 and 2A.2 below.

### **2A.1 Job Order Contracting**

Job Order Contracting is a delivery method for recurring and periodic works for which the quantity, specifications and timing cannot be ascertained accurately in advance. This method is suitable for maintenance, repairs, renovations, alterations and non-major upgrading of facilities. However, this method is not appropriate for construction of a new facility.

Using this method, a single contract can be used for works spanning several years without the need for fresh bids every time such services or works need to be done, thus saving the owner both time and money. Further, the contractor gains familiarity with the facility which in turn helps in terms of productivity as opposed to having a new contractor familiarizing with the facility each time work is done<sup>56</sup>.

### **2A.2 Mutual Cooperation Delivery Method (MCDM)**

In the olden days, building a traditional Malay house in Malaysia involved a whole community or at least the extended family and friends. This form of delivery system is based on the Malay concept of “gotong royong” or mutual cooperation. In this method, the owner in consultation with old-timers, designs and builds his house with the help of fellow villagers. The building

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<sup>56</sup> <http://proquest.umi.com/pqdweb?did=896344161&sid=3&Fmt=3&clientId=5482&RQT=309&VName=PQD>, Director, Alliance for Construction Excellence, Del E. Webb School of Construction, Southwest Contractor, Sep 2005. Vol. 66, Iss. 9; p 49

crafts are normally passed on from father to son, mother to daughter and master to apprentice. This cooperative delivery method ensures consistency of designs and structures within the village.<sup>57</sup>

To ease the housing shortage in the 1970s<sup>58</sup>, the government had initiated low-cost housing schemes where the houses are sold at the regulated price of RM25,000 (equivalent to about US\$8,500). This program has been successful in overcoming the housing shortage in Malaysia through a series of housing policies, incentives and disincentives and subsidies for the poorer income groups.<sup>59</sup> However, as far back as 1993, a study suggested that the mass-built low-cost housing may not be an effective housing delivery system for the hard-core poor who are at or below survival thresholds.<sup>60</sup> An alternative would sweat equity along the lines of MCDM.

However, this student is of the opinion that Malaysia is a fast developing country where overall hardcore poverty had declined from 1.9% in 1999 to 1.2% in 2004<sup>61</sup> and as such, mass-built low-cost housing is a more effective project delivery method due to economy of scale while self-build delivery method can be used as an alternative in special cases. It had been noted that with the advent of modern construction technology, the number of traditional craftsmen for the MCDM are decreasing and today, there are only few craftsmen left.<sup>62</sup>

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<sup>57</sup> Choo, Tech Neo, *The Application of Traditional Design Principles to Contemporary Housing in Malaysia*, Master Thesis, MIT, June 1982.

<sup>58</sup> According to Mohd. Rosli b. Buyong, there was a housing shortage of 121,216 living quarters in 1970. (See *Public and Private Housing in Malaysia*, Tan Soo Hai and Hamzah Sendut, Heinemann Educational Books (Asia) Ltd, 1979, p 170. This housing shortage was made even more severe by urban-rural migration and rapid population growth.

<sup>59</sup> World Bank, *Malaysia: The Housing Sector: Getting the Incentives Right*, 1989, 61. There was also a discussion paper by Steven Malpezzi (World Bank, 1988) on *Analyzing Incentives in Housing programs: Evaluating Costs and Benefits With a Present Value Model*.

<sup>60</sup> Yusoff, Noraini, *A Culturally Appropriate and Economically Sustainable Housing Delivery System for Malay Urban Low-Income Households in Malaysia*, PhD Thesis, Texas A & M University, UMI, Bell & Howell Co., 1994

<sup>61</sup> 9<sup>th</sup> Malaysia Plan, 2006-2010, <http://www.epu.jpm.my/rm9/english/Chapter1.pdf>

<sup>62</sup> Hassan, Ahmad Sanusi, *Issues in Sustainable Development of Architecture in Malaysia*, Universiti Sains Malaysia Publisher, 2004.

## Chapter 3 Project Delivery in Malaysia

### 3.1 Overview

There are essentially three commonly used project delivery methods in Malaysia

First, the most popular project delivery method is design-bid-build general contracting. In this project delivery method, the architect or engineers play a very significant role from inception to completion. The most common standard forms used are PAM 1998<sup>63</sup> (successor to PAM 1969), the IEM<sup>64</sup> and JKR<sup>65</sup> (PWD) 203 forms. There is also a CIDB 2000 form recently introduced by the Construction Industry Development Board.

Second, the less common approach which is gaining some acceptance is the design-build method. There is currently a standard JKR (PWD) design-build form which is not widely circulated.

Third, the mode of delivery for infrastructure projects is often Build-Operate-Transfer. This is especially common for highway projects where the developer/builders collect tolls for a number of years before handing back the project in toto to the government.

There can also be a combination of methods using design-build with project management and/or BOT financing.

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<sup>63</sup> PAM stands for Persatuan Akitik Malaysia which means Malaysia Institute of Architect

<sup>64</sup> IEM stands for Institute of Engineers Malaysia

<sup>65</sup> JKR stands for Jabatan Kerja Raya which means Public Works Department

It should be noted, however, that ideally the construction industry should be ready for the alternative project delivery method before its implementation. For example, if an owner chooses to have an open bid through the design-build project delivery method, there should be enough design-build contractors in the industry for the bidding process to be competitive and successful. This can result in a chicken and egg situation where one can in turn argue that if there are no design-build project up for tender, no contractor is going to venture into the design-build method.

In the past, a particular project delivery method was often adopted based on the recommendations of the architect, quantity surveyor or engineer as the case may be. The architect, quantity surveyor or engineer often adopts the delivery method most familiar to him or her which is the design-bid-build method. This one-size-fits-all approach may not be the optimal solution in terms of efficiency, cost-effectiveness and timeliness.

### **3.2 Overall Contracting Framework**

In the modern day construction industry, projects are getting increasingly complex and often the myriad project delivery methods coupled with the award system, contracting principles and differing modes of remuneration form a labyrinth of maze for the uninitiated. For ease of reference, an overall diagrammatic representation of the contracting framework is represented in the Figure 9 below.<sup>66</sup>

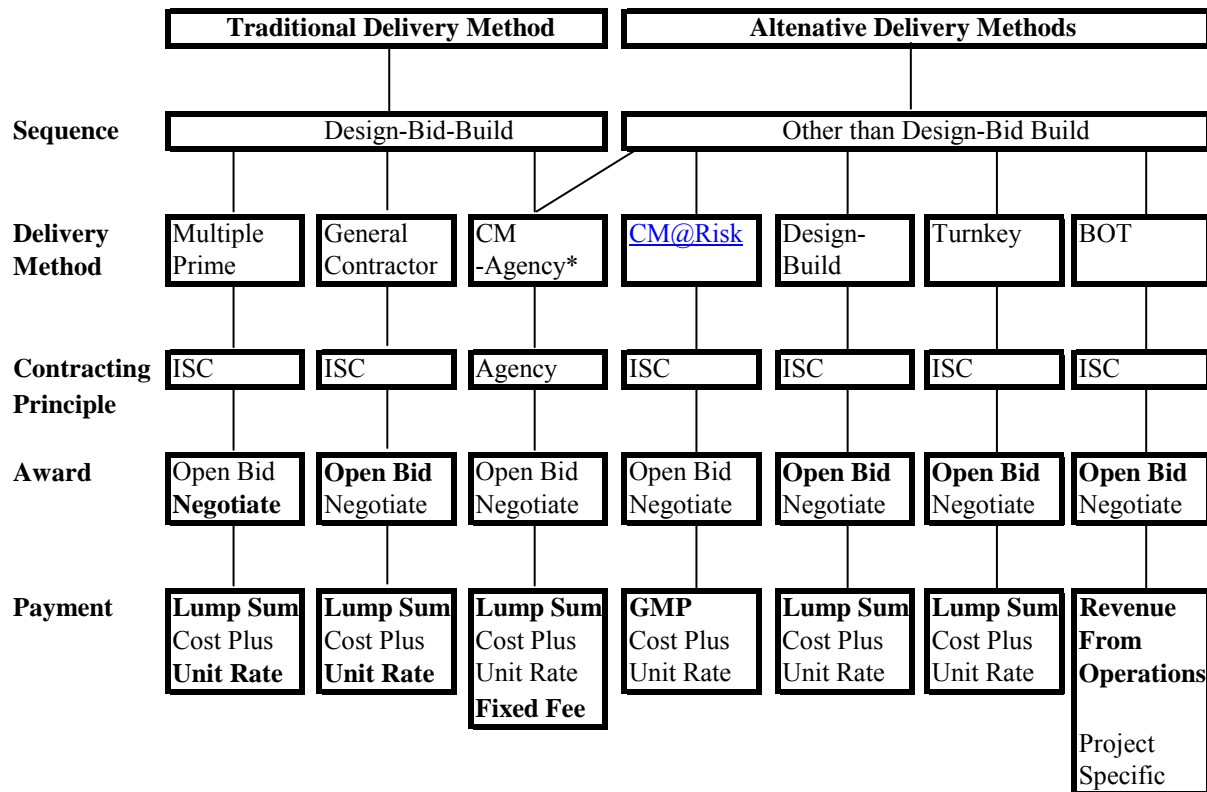
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<sup>66</sup> See also Table of Construction Contracting Methods Components (Gordon 1994), p 197

In summary, the helicopter view of the overall contracting framework is that it can be divided into two categories: the traditional delivery method and the alternative delivery methods. Between the traditional delivery method and the alternative delivery methods, there are six main delivery methods. The contracting principle behind each method is that the contractor is either an independent subcontractor or an agent of the owner. (In fact, CM-Agency is the only mode where the “contractor” is an agent.) Further, the award of the contract under each delivery mode can be through open bid or negotiation (with one or more parties). For example, an experienced “multiple prime” owner may choose to negotiate with the various prime contractors rather than having too many bids for each of the many components of the works. Finally, the payment for the works can be based lump sum, cost plus, unit rate or a combination of the three modes of payment. For BOT projects, revenue from operations is often based on per unit usage such as the toll charge per vehicle.

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**Legend:**

ISC = Independent Subcontractor

\* In CM-Agency where the CM plays an advisory role, the delivery method can be either under the Traditional Delivery Method or Alternative Delivery Methods.

**Bold** = The more common mode(s) within each category

**Figure 9: Overall Contracting Framework**

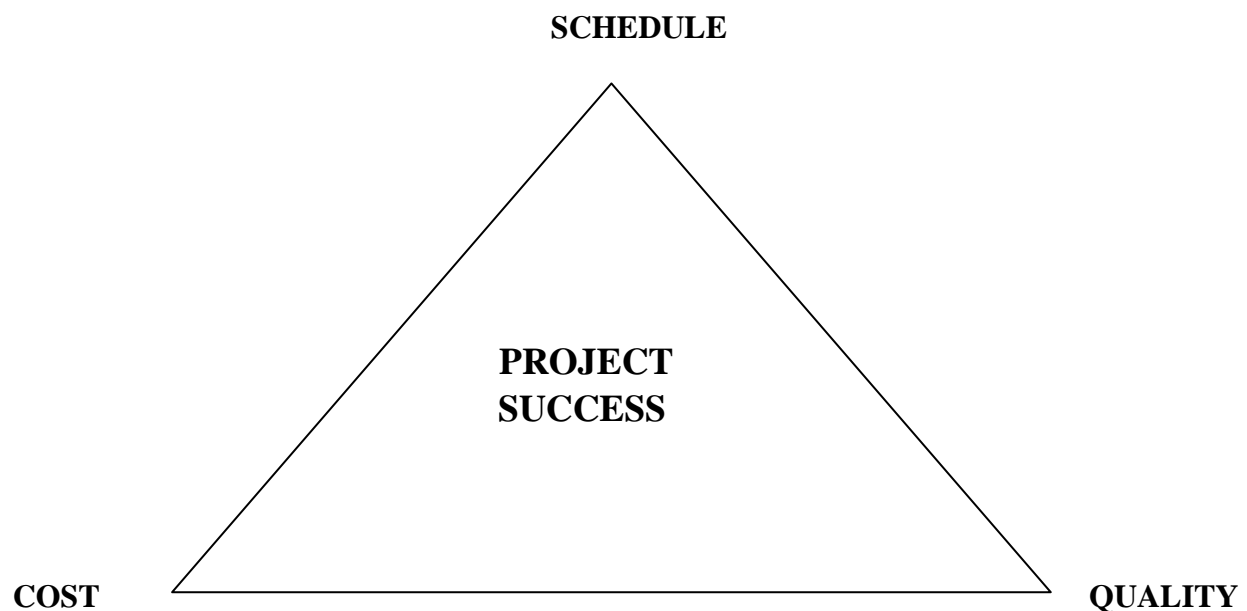
### 3.3 Useful Considerations for Project Delivery in Malaysia

According to Lawrence Chan (Chan 1997), real estate project delivery in Malaysia can be divided into eight main stages, namely:

- (1) Schematic and layout submission
- (2) Planning Submission
- (3) Building Approval Submission
- (4) Tender Documentation

- (5) Tendering Stage
- (6) Construction Stage
- (7) Certificate of Fitness for Occupation
- (8) Issuance of strata title (sub-divided building) or individual sub-divided title.<sup>67</sup>

What does one mean when an owner is said to have chosen “the best project delivery method in Malaysia”? The best project delivery method is one which optimally meets or exceeds the three key criteria of successful project delivery: schedule, cost and quality<sup>68</sup>. (See Figure 10 below.) Schedule means completion within the time frame as contracted in the project delivery method. Cost means completion of the project within the cost budgeted and contracted. Quality means completion of project in compliance with the specifications as contracted.



**Figure 10: Triumvirate of Schedule, Cost and Quality for Project Success**

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<sup>67</sup> Chan, Lawrence., Housing Delivery System: The Industry Viewpoint., Housing The Nation : A Definitive Study, Cagamas Berhad, 1997, p 604.

<sup>68</sup> Op Cit., Tenah

Generally, the above triumvirate of criteria for successful project delivery is as applicable to Malaysia as it is to other countries. However, it is important to make a distinction between a successful project delivery and a successful viable commercial project. The latter depends ultimately on the commercial viability of the project and not the manner the project is delivered. And choosing the best delivery method involves matching key attributes of the owner and the project on the one hand with the key characteristics of project delivery method on the other.

For ease of reference, certain key features of the six main delivery methods are restated in this chapter.

As mentioned earlier, there are six main categories of project delivery methods<sup>69</sup>. The design-bid-build method and the turnkey method are similar in approach. One school of opinion defines the turnkey method as design-build plus short-term financing<sup>70</sup> while others define it to be design-build plus interiors and/or commissioning to the extent that the contractor just completes everything and hand-over the keys. This thesis adopts the latter definition for the turnkey method in its application in Malaysia.

### **3.3.1 Multiple Prime Contracting**

This is a delivery method where the owner contracts directly with each subcontractor for works ranging from foundation and piling to the final finishes.

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<sup>69</sup> Op. Cit., Gordon, Christopher M.

<sup>70</sup> Ibid. Christopher Gordon defines the turnkey method as Design-Build plus short-term financing.

## **Multiple Prime Contracting: Owner and Project Attributes**

The key owner attributes include:

- (i) Ability to finance the project himself.
- (ii) Having sophisticated knowledge of construction.
- (iii) Having ability to manage the construction process.

The multiple prime contracting delivery method is applicable to practically all projects if the owner has the sophisticated knowledge of construction and the ability to manage the construction process.

Based on a discussion with a successful high-end developer in Malaysia, this mode is clearly workable with the owner having a great deal of control over the design and construction process.

## **Multiple Prime Contracting: Standard Construction Contract Form**

Given the contracts that the owner must use with each of the various prime contractors for the project, there is no one size fit all standard form of construction contract for this project delivery method. For general works, the owner may choose to use the PAM 1998 form with modifications and for civil, mechanical and electrical works, the owner may use the IEM forms with modifications.

### **3.3.2 General Contractor<sup>71</sup>**

This is the traditional design-bid-build method. In this method, the owner hires a designer who designs the project according to the owner's visions, objectives and budget. General contractors are invited to bid based on the tender documents. The winning bidder then proceeds to construct according to specifications.

#### **General Contractor: Owner and Project Attributes**

The key owner attributes include:

- (i) Ability to finance the project himself.
- (ii) Ability to give design instruction to the architect.

The key project attributes include:

- (i) No fast-tracking of the project.
- (ii) Sequential construction.
- (iii) Less flexibility in design once the construction has begun.

If all the above attributes are present, the General Contractor method is an appropriate delivery method for the project.

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<sup>71</sup> In Malaysia, a general contractor is often offered to as the main contractor.

The owner has to understand that this method is time-consuming in that the work is sequential: first, the design has to be completed 100%; second, the bidding process and selection process and third, the actual construction. There is no pre-construction advice from the contractor. Further, it is very expensive to make design and/or work changes as this will attract change orders<sup>72</sup> which are likely to be costly. In addition, cardinal changes<sup>73</sup> are not allowed which is to say that the owner is not allowed to request changes which are tantamount to changing the character of the contract.

### **General Contractor: Standard Construction Contract Form**

In Malaysia, PAM 1998 and its predecessor PAM 1969 standard form of contract had been successfully used for this delivery mode. Other standard forms of contract commonly used are the IEM Contracts which are usually used for engineering works and JKR 203 Contract for government jobs.

### **3.3.3 Construction Management**

This is a method not commonly used in Malaysia. In this method, the owner hires a construction manager who advises the owner in consultation with the architect. There are many variants to this delivery method. The construction manager can be hired purely as an agent or alternatively, as a construction manager at risk with guaranteed maximum price.

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<sup>72</sup> Change order is referred to as variation order in Malaysia and other commonwealth countries.

<sup>73</sup> Cardinal change is referred to a substantial change in Malaysia and other commonwealth countries.

It should be noted that recently, project management consultants have been introduced in the public sector through the Ministry of Finance in Malaysia with mixed results.

Often, the terms construction (project ) management and project management are used interchangeably. It is submitted that a more accurate representation would be that construction (project) management is a subset of project management which may include non-construction functions such as sales and marketing.

Based on the author's experience, CM-Agency had been used recently in Malaysia through project management consultants. However, CM @ Risk with GMP is not used in Malaysia, certainly not in the current mainstream.

Key contractual terms of a CM @ Risk contract may include provisions for a Guaranteed Maximum Price (GMP), relationship between the parties, covenant to cooperate with the architect, acknowledgement of sufficiency of documents, inspection and testing of site in order to contract and build, performance milestones, performance bonuses, liquidated damages, GMP to include construction manager's fees plus cost of works, payment mechanism and mechanism for changes of work.<sup>74</sup> GMP is also sometimes known as GMAX.<sup>75</sup>

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<sup>75</sup> Levy, Sidney M., Project Management in Construction, McGrawl-Hill Inc, 1994, p 14.

## **Construction Management: Owner and Project Attributes**

The key owner attributes include:

- (i) Ability to finance the project himself.
- (ii) Needs pre-construction advice.

The key project attributes include:

- (i) Allowing for fast-tracking of the project.
- (ii) Complicated and complex project.

## **Construction Management: Standard Construction Contract Form**

In view of the many variants of the construction management delivery method and its late introduction in Malaysia, inquiries by the author do not show availability of any standard construction contract form on this mode of delivery from any professional organization in Malaysia. However, principles behind construction management contracts in USA or other countries can always be adapted for use in Malaysia with adjustment to suit local conditions. For example, CM @ Risk contracts may be prepared in consultation with an attorney using the 2004 Construction Manager at Risk Standard Contract Document from Construction Management Association of America or AIA 121<sup>TM</sup>CMc203 from the American Institute of Architects, with modifications. Additionally, CM-Agency contracts may be prepared using AIA Document B801.



### **3.3.4 Design-Build**

In this mode of delivery, the owner works closely with the designer to come up with sufficient design to request for proposals from design-build contractors. The design-build contractors will in turn submit their proposals to the owner for acceptance. Thereafter, the owner, after having reviewed the contractors' proposals from both the technical and commercial perspectives, may decide to accept one of the proposals or none at all.

The above is a common modus operandi for the design-build delivery method in Malaysia. However, it should be noted that there are many variants in this delivery method. For example, a two-tier bidding mechanism can be put in place. During the first tier selection, contractors are chosen based on their technical proposals. In the second tier selection, the contractor with the lowest bid wins the award.

In terms of design, it is common in Malaysia for the services of the owner's architect to be novated to the contractor. An alternative to this novation method would be the bridging-design method. The original designer can complete the first 25% to 35% design works and drawings and the balance design and construction can be performed by the contractor and his designer.<sup>76</sup>

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<sup>76</sup> Friedlander, Mark C., *Journal of Management in Engineering*, Nov-Dec 1998, 63.

## **Design-Build: Owner and Project Attributes**

The key owner attributes include:

- (i) Ability to finance the project himself.
- (ii) Having limited resources to oversee the post-award construction process.

The key project attributes include:

- (i) A sizeable project in terms of cost and duration.
- (ii) Some room for value-added in terms of design and value engineering.

## **Design Build: Standard Construction Contract Form**

At the moment, there is no standard form of construction contract from professional organizations for the design-build delivery method in Malaysia. There is, however, a Design-Build Form 2000 from the Public Works Department but it is not widely circulated to the public. In addition, there are various design-build standard forms of contract which may be used as references: the JCT<sup>77</sup> Form, FIDIC<sup>78</sup> Form and the standard forms used in other countries.

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<sup>77</sup> Joint Contracts Tribunal, UK

<sup>78</sup> International Federation of Consulting Engineers

### **3.3.5 Turnkey**

The description in 3.3.4 above in relation to design-build method applies correspondingly to the turnkey method. The difference is that in the turnkey method, the contractor works to the extent that the owner needs only to turn the key. Hence, particular attention is needed to augment the design-build method with interiors and/or commissioning requirements.

### **3.3.6 Build-Operate-Transfer (BOT)**

In the build-operate-transfer delivery mode, the contractor essentially designs, builds, finances, operates and ultimately transfers the project to the owner. In Malaysia, this usually involves infrastructure projects such as highways, light rapid transit systems, sewerage and water supply projects. Often, the build-operate-transfer delivery mode is also used to achieve privatization objectives.

#### **BOT: Owner and Project Attributes**

The key owner attributes include:

- (i) Inability to finance the project himself.
- (ii) Not having the technical expertise to build and operate the facility.

The key project attributes include:

- (i) A sizeable complex project in terms of cost and duration.
- (ii) Some room for value-added in terms of design and value engineering.
- (iii) Some room for technology transfer.

### **BOT: Standard Construction Contract Form**

Based on the writer's experience and inquiries, there is no standard form for build-operate-transfer contract in Malaysia. Given the complexity of the projects involved, preparation of the contracts are done by lawyers specialized in the field in consultation with expert consultants on a project to project basis.

### **3.4 Summarizing: The Decision Making Process in Choosing the Delivery Methods**

The decision process where considerable judgment and experience is required can be approached in an intuitive manner or in a more methodological, structured manner. The matrix in 3.4.1 and the decision tree in 3.4.2 can add a methodological dimension to the decision making process. As projects become more complex, intuition alone may not suffice in decision making.

### **3.4.1 Delivery Methods vs. Key Owner/Project Attributes Matrix**

One system of choosing the best delivery method is to go through a matrix which combines the delivery methods with the owner/project attributes as per Figure 11 below. The first step is to go through the process of elimination.

For example:

(i) If the owner has no funds of his own, access to borrowings or other sources of finance, BOT would seem like the only solution with other delivery methods being excluded.

(ii) If the owner has no construction knowledge, the Multiple Prime Contracting method would have to be excluded.

Having gone through the elimination process, the owner may end up with a few right methods and would still need to use his experience and judgment in conjunction with quantitative and qualitative analysis to choose the best delivery method. In construction parlance, this is akin to choosing a screw driver. There are wrong screw drivers but there are also a few which can do the job. The question is, therefore, selecting the one which fits best.

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### Owner/Project Attributes

<b>Delivery Methods</b>	<b>CI</b>	<b>DI</b>	<b>OCK</b>	<b>FIN</b>	<b>CCA</b>	<b>FT</b>	<b>DC</b>	<b>CCC</b>	<b>COF</b>
<b>MP Con</b>	N	Y	Y	Y	Y	Y	Y	N	N
<b>Gen Con</b>	N	Y	N	Y	N	N	N	Y/N	N
<b>CM-Ag</b>	Y	Y	N	Y	N	Y/N	Y/N	Y/N	N
<b>CM@Risk</b>	Y	Y	N	Y	N	Y	N	Y/N	N
<b>Design-B</b>	N	Y/N	N	Y	N	Y	N	Y	N
<b>Turnkey</b>	N	Y	N	Y	N	Y	N	Y	N
<b>BOT</b>	N	N	N	N	N	Y	N	Y	Y

Legend: Y = Yes; N = No

#### Owner/project Attributes

CI (Contractor's Input): Does owner need contractor's pre-construction input?

DI (Designer's Input): Does owner need designer's input?

OCK (Owner's Construction Knowledge): Does owner have strong construction knowledge?

FIN (Owner's Finance) – Is owner able to finance the project?

CCA (Construction Contracts Administration) – Does owner need to have construction contracts administration ability?

FT (Fast-tracking) – Can the project go fast-track?

DC (Design Change) – Can owner effect design changes without prohibitive cost?

CCC (Cap on Construction Cost) – Can owner put a cap on construction cost at the outset?

CFO (Contractor to Operate Facility) – Does owner need contractor's expertise to operate facility?

**Figure 11: Delivery Methods vs. Owner/Project Attributes**<sup>79</sup>

<sup>79</sup> This matrix uses Christopher Gordon's Project Drivers vs. Organization Matrix as a reference. Op. Cit., Gordon 1994 as a reference. See all Classification of Contracts, Elliott 1998, pp 1-20 to 1-48

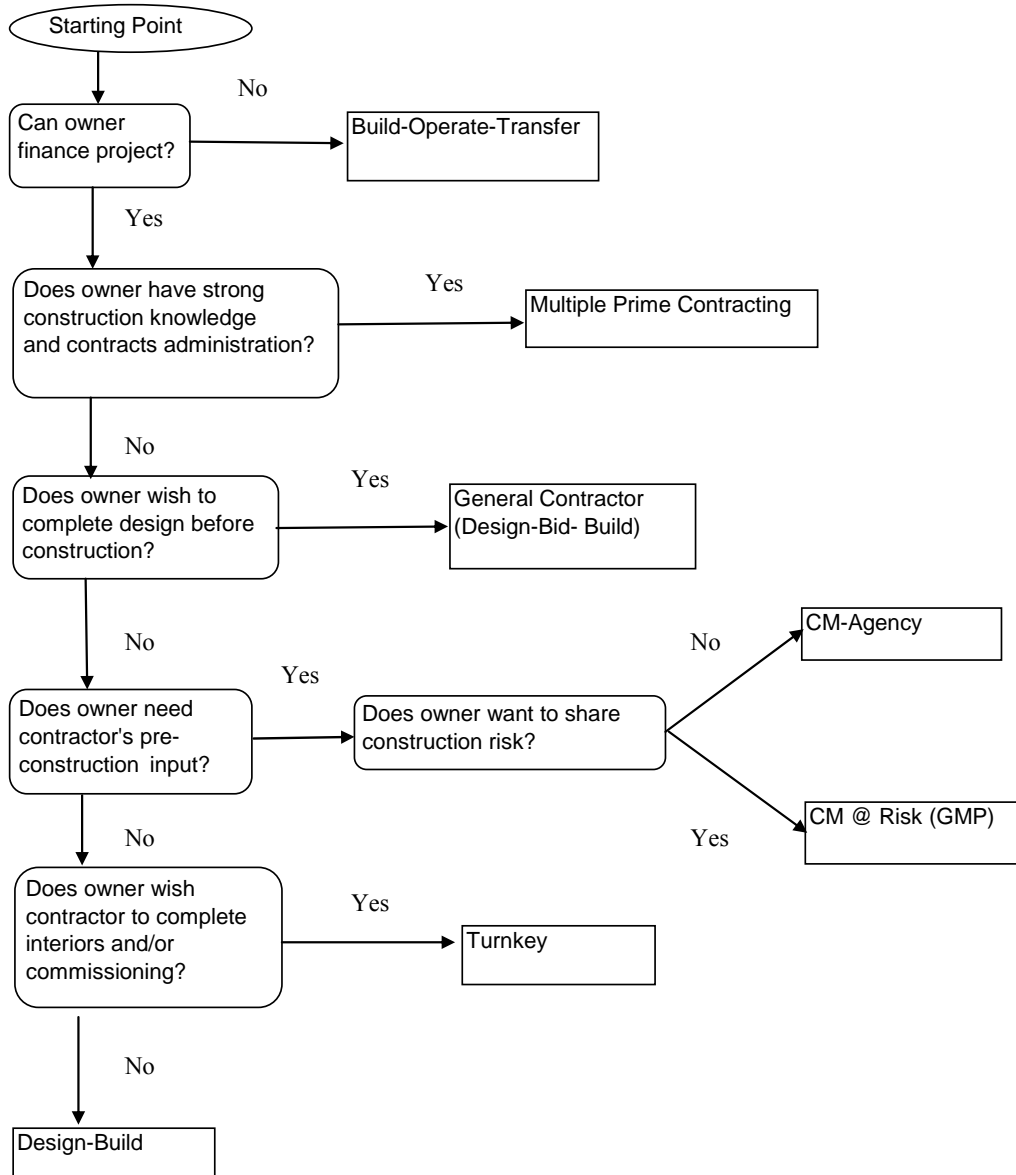
### 3.4.2 Project Delivery Methods Decision Tree

Corollary to the matrix in Figure 11 above, the owner can also use a decision tree to help him choose a delivery method. The decision tree may differ from owner to owner depending on the project and the questions asked. There is no one size fit all solution but it can be used as a framework for decision-making in choosing the best delivery method.

Using the framework below, the first question for the owner to ask is: “Do I have the finance or at least access to finance to carry out the project?” If the answer is no, BOT would be the suggested choice or the project would not go ahead for lack of funds. If the answer is yes, then proceed to the second question: “Do I have strong construction knowledge and contracts administration?” If the answer is yes, Multiple Prime Contracting could be a suitable method. This questioning process continues until a suggested solution is found.

The decision tree in Figure 12 below is a pro-forma model. However, with proper fine-tuning and right questions being addressed, it can be an effective decision-making tool for selection of project delivery methods.

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**Figure 12: Project Delivery Methods Decision Tree**



## **Chapter 4 Conclusion**

There are many factors which can contribute to the success of a project and choosing the best or right delivery method is an important factor. However, choosing the best delivery method is not hard science. It relies heavily on the judgment and experience of the decision maker coupled with quantitative and qualitative analysis. While there are usually delivery methods which are wrong, there can be a few methods which are right. And through the thorough review of the owner attributes, project attributes and delivery method characteristics, the best or right solution could be found with the appropriate allocation of risks between the owner and the contractor. The key attributes matrix and the pro-forma decision tree may be used as decision tools.

The focus of this thesis is on improving project delivery by choosing the best project delivery method. This is to be differentiated from concepts and systems which can improve project delivery in Malaysia across all methods.

The following are some areas where further research can improve project delivery in Malaysia:

### **(i) Partnering**

Partnering can be viewed as a working relationship to minimize adversarial tendencies and maximize cooperation. The partnering concept arose from the early efforts by the U.S. Army Corps of Engineers to minimize cost and delays from disputes, claims and litigation. Steps taken by the U.S. Army Corps of Engineers include workshops and team-building effort. These early

efforts have gradually matured into the partnering concept of today.<sup>80</sup> One valuable example of partnering is the Bechtel Procurement Strategic Supplier Program implemented in the early 1990s.<sup>81</sup> (Schutzel 1996)

## **(ii) Value Engineering**

The concept of value engineering emerged during the Second World War when materials and labor shortages put pressure on methods, materials usage and design. The application of value engineering resulted in changes which brought superior performance and lower cost. After the Second World War, the General Electric Company pioneered and implemented various value engineering programs.<sup>82</sup>

Value engineering is defined as "an analysis of the functions of a program, project, system, product, item of equipment, building, facility, service, or supply of an executive agency, performed by qualified agency or contractor personnel, directed at improving performance, reliability, quality, safety, and life cycle cost."<sup>83</sup>

## **(iii) Automation and Robotics in Construction**

Automation and robotic construction technologies have been developed and used in Japan since 1980s. However, it should be noted that the construction industry is a skilled and craft-oriented

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<sup>80</sup> Schutzel, Henry J and Unruh, Paul V., Successful Partnering – Fundamentals for Project Owners and Contractors, John Wiley & Sons, Inc, 1996, p 19.

<sup>81</sup> Ibid, p 131.

<sup>82</sup> Op. Cit., Tenah, Kwaku A., pp 217-218.

<sup>83</sup> Institute of Defense Analysis, <http://ve.ida.org/ve/ve.html>

labor-intensive industry which makes automation difficult and challenging.<sup>84</sup> Despite the industry constraints, construction robots were built for specific tasks such as structure construction works (including fire-proofing, steel welding, iron-bar placing, concrete placing, concrete finishing, remote wire-releasing, exterior wall spraying, ceiling panel placing and light-weight wall panel handling), inspection works and maintenance works (including coating glass cleaning and floor cleaning).<sup>85</sup>

There are at least one hundred and fifty types of construction robots which have been developed for the construction industry in Japan.<sup>86</sup> However, it should be noted that implementation of robotics in Malaysia is likely to be in the distant future given her level of development as compared to advanced countries like USA and Japan.

#### **(iv) Leveraging IT and the Internet**

Apart from normal benefits of operational efficiency and productivity, the manners in which IT and the internet can improve project delivery include:

(a) Implementation of a Web-based Project Management System. For this to be successful, there is a need to synergize the hardware, software and the human elements. In regard to the human

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<sup>84</sup> Maeda, Junichiro, Current Research and Development and Approach to Future Automated Construction in Japan, Construction Research Congress 2005

<sup>85</sup> Ibid

<sup>86</sup> Ibid., per Architectural Institute of Japan.

elements, the players have to be not only technically ready but also mentally prepared to accept new ways of doing things.<sup>87</sup>

(b) Using IT tools for a systematic briefing process. The client's brief documents his initial intentions for the project which are in turn communicated to the project team. The briefing process also includes the various communication and clarifications on the meanings and intents of various documents, designs, drawings and pro-formas during the pre-construction planning stage.<sup>88</sup>

(c) Using e-commerce to enhance supply chain management. This could result in savings in terms of cost and time. Supply chain management can be defined as “the practice of a group of companies and individuals working collaboratively in a network of interrelated processes structured to best satisfy end-customer needs while rewarding all members of the chain.”<sup>89</sup>

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<sup>87</sup> Nitithamyong, Pollaphat and Skibniewski, Miroslaw, Critical Success/Failure Factors in Implementation of Web-Based Construction Project Management Systems, Construction Research Congress 2003

<sup>88</sup> Seay P. Cheong, Chimay J. Anumba, Robert Hill and Dino Bouchlaghem, Improving Construction Client Satisfaction Through Functional Briefing, Construction Research Congress 2003

<sup>89</sup> Tommelein, Iris D., Akel, Nadia, and Boyers, J.C., Capital Projects Supply Chain Management: SC Tactics of a Supplier Organization, Construction Research Congress 2005: Quoting Tommelein et al. (2002)

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