

A STUDY OF CURRENT DESIGN & BUILD PROCUREMENT APPROACH  
PRACTICE BASED ON THE CLIENT'S SPECIFIC EXPECTATIONS IN THE  
MALAYSIAN CONSTRUCTION INDUSTRY

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## ABSTRACT

Design and build procurement approach is being considered as one of the innovative procurement approaches that is widely gaining popularity globally. The Malaysian construction industry is not left out in the growing adoption of this procurement approach, this could be attributed to the several advantages that the system offers to construction clients which includes single point responsibility, fixed cost, shortened project duration and risk allocation. However, with all these inherent advantages of the procurement approach, it is yet to be effectively adopted and practiced in the Malaysian construction industry. This study is aimed at appraising the Design & Build (D&B) procurement approach in the Malaysian Construction Industry based on current practice through identifying the impeding and enabling factors to the achievement of the client's specific expectations in order to enable the better practice of D&B procurement approach in the industry. Data was collected from a two round Delphi questionnaire survey which was conducted in Malaysia in order to identify the features that characterize the D&B procurement approach, and also the impeding and enabling factors in the achievement of the client's specific expectations. The key findings in the study showed that the practice of the system in Malaysia is most importantly characterized by the fact that the system is most suitable for projects that are complex in nature. Whilst the impeding and enabling factors in the achievement of the client's specific expectations which are attributed to be client related, contractor related and also external environment related was determined. It is expected that with the consideration of these impeding and enabling factors to the achievement of the client specific expectations, it will consequently result in the enhanced D&B project delivery, the better practice of the procurement approach; and ultimately the overall improvement of the performance of the Malaysian construction industry in relation to D&B projects.

## ABSTRAK

Rekabentuk dan pendekatan perolehan bangunan merupakan salah satu sistem perolehan inovatif yang mendapat sambutan secara global dan meluas. Industri pembinaan Malaysia tidak terkecuali dalam pengembangan pelaksanaan sistem, yang menyumbang kepada beberapa kelebihan yang ditawarkan kepada klien sektor pembinaan termasuk tanggungjawab mutlak, kos tetap, memendekkan tempoh masa projek dan peruntukan dana risiko. Tetapi dengan kelebihan yang terkandung dalam sistem ini, seharusnya diaplikasikan dalam industri pembinaan Malaysia. Kajian ini bermatlamat untuk menilai reka dan bina dalam sistem perolehan industri.

Pembinaan Malaysia berasaskan praktis terkini dengan mengenal pasti faktor penghalang dan faktor penggalak kepada kejayaan seperti jangkaan klien. Bagi membantu praktis terbaik dalam sistem perolehan reka bina dalam industri, data dikumpul melalui borang soal selidik menggunakan kaedah Delphi yang diagihkan sebanyak dua kali dijalankan ke atas industri pembinaan di Malaysia dalam mengenalpasti faktor yang menggambarkan sistem perolehan reka bentuk serta faktor penghalang dan penggalak terhadap kejayaan seperti jangkaan klien pembinaan Malaysia. Penemuan-penemuan utama dalam kajian ini menunjukkan bahawa amalan sistem di Malaysia yang paling penting dicirikan oleh hakikat bahawa sistem yang paling sesuai untuk projek-projek yang kompleks dalam alam semula jadi. Manakala faktor-faktor yang menghalang dan membolehkan dalam pencapaian harapan pelanggan tentu yang disebabkan oleh pelanggan yang berkaitan, kontraktor yang berkaitan dan juga persekitaran luar yang berkaitan telah ditentukan. Selain itu, faktor-faktor yang menghalang dan membolehkan pencapaian kehendak tertentu pelanggan terus menduduki tempat dalam perintah itu keutamaan mereka.

Diharapkan bahawa dengan pertimbangan ini faktor-faktor yang menghalang dan membolehkan pencapaian yang jangkaan pelanggan tertentu, akibatnya akan menyebabkan peningkatan D & B projek penghantaran, itu amalan yang lebih baik sistem pemerolehan; dan akhirnya yang peningkatan keseluruhan prestasi industri pembinaan Malaysia berhubung dengan projek-projek D & B.

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**LIST OF SYMBOLS AND ABBREVIATIONS**

- D&B - Design and Build
- W - Summation of the weighing to each success factor
- A - Highest ranking
- N - Total number of respondents for that factor

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background of the study**

The construction industry is a very important aspect of a nation's economy, because it provides the basis through which basic infrastructures such as roads, hospitals, schools and other basic and enhanced facilities could be provided in the society with the sole aim of promoting and sustaining socio-economic growth and development. Construction refers to the processes of building physical structures and related activities. Currently, it is a process which has its end product to be site specific and involves the assembly of various human, financial and material resources over a period of time towards the achievement of a built facility.

The construction industry can be defined as the sector of economy which plans, designs, constructs, alters, maintains repairs and eventually demolishes buildings of all kinds. The various construction jobs often are sub-classified as civil engineering works, structural works, mechanical and electrical engineering, and architectural works.

The construction industry plays a vital role towards the development of Malaysia's economy. The sector is also known to play an important role towards improving the quality of life of the Malaysian citizenry by providing the necessary socio-economic infrastructure. The construction industry is a significant contributor to the Gross Domestic Product (GDP) of Malaysia's economy, as the sector had been

consistently contributing an average of 3.8% over the last thirty years (Construction Industry Development Board, 2010) and also the sector has provided job opportunities for approximately 800,000 people, this is besides the multiplier effect that the sector has to the other sectors such as the financial, manufacturing and professional services (Construction Industry Development Board, 2007). The sector has continued to grow despite the present global economic downturn, where the sector registered a growth of 3.5% in the year 2009, thereby making the sector an important pillar of the Malaysian economy (Construction Industry Development Board, 2007). In the Malaysian construction industry, the private sector is known to be ahead in the total value of projects executed, with the total value of private sector projects in the year 2009 totalling to around RM 29 billion, compared to that of the public sector which totals to around RM 28 billion (Construction Industry Development Board, 2010).

According to Construction Industry Development Board (2010), the activities of the Malaysian construction industry is regulated by the Construction Industry Development Board (CIDB), the board is saddled with the responsibilities of:

- coordinating the needs and wants of the construction industry;
- planning the direction of the construction industry;
- addressing the pertinent issues and problems facing the construction industry;
- making recommendations in the formulation of policies for the construction industry .

In the year 2007, a ten year master plan, Construction Industry Master Plan (CIMP 2006 – 2015) for the Malaysian construction industry was formulated by the CIDB, the master plan is aimed at ensuring that the industry develops into a world class, innovative and knowledgeable global solution provider. Additionally, the master plan is intended to ensure that the industry is in a good position to support the overall growth of the economy, as well as ensure that the industry is abreast with the global standards regarding quality and productivity (CIMP 2006-2015, CIDB).

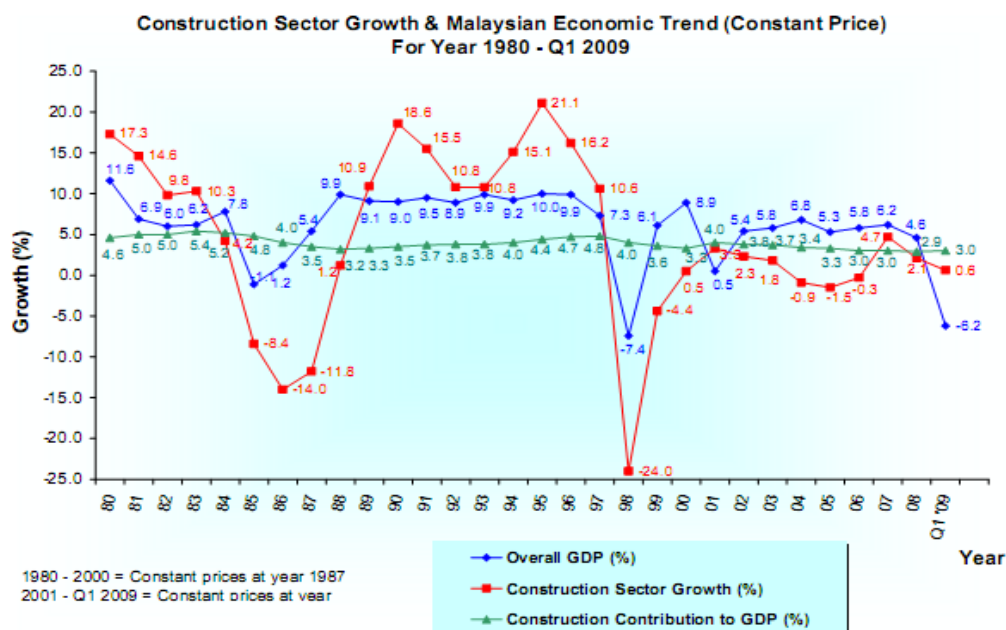


Figure 1.1: The construction sector growth and the Malaysian economic trend for the year 1980 – Q1 2009 (Construction Industry Development Board, 2010).

All construction contracting companies in Malaysia are required to register with CIDB, and they are graded from G1 to G7 in accordance to their financial capabilities, tendering capacities and the availability of human resources.

As of the year 2006, there were 3751 contractors with the highest level grade, which is G7, out of a total of 62,884 contractor organizations that do practice in the Malaysian construction industry (Construction Industry Development Board, 2007).

All construction activities are organized and achieved through a procurement system. It serves as an entry point through which the desire of a client to obtain a constructed facility is achieved. The selection of a procurement system for a construction work is one of the most important decisions that construction clients have to make. This is so because, the system has an overall impact on how the project is to be executed, ranging from the pre-contract work, to the employer's financial and human resources, as well as issues relating to the risk transfer and the allocation of responsibilities under the contract. According to Best & Devalance(2002), building procurement from inception to commissioning is a complex undertaking, bringing together the set of skills and knowledge that are



required for successful completion of building and construction projects. Since the construction procurement determines the overall framework and structure of responsibilities and authorities for participants within the construction process, therefore it is being considered to be a key factor which contributes to the achievement of the overall strategic goals of the client and project success (Ratnasabathy & Rameezdeen, 2007).

There are various forms of building procurement systems which can be adopted for organizing a building project. In construction, as identified by Masterman (2002), building procurement systems are generally categorized into the following: (a) Separated procurement systems; (b) Integrated procurement systems; (c) Management oriented procurement systems; and (d) Discretionary procurement systems.

**1.1.1 Separated procurement systems:** This is also known as the conventional system. This system is characterized with the separation of the design and construction phases of a project. The traditional procurement approach is the basic known type of the separated procurement approach. In this procurement approach, the client first approaches the independent consultants, who produce the outline designs and also prepares the bill of quantities. Tender documents are prepared to enable contractors to tender for the proposed project. Tenders are then submitted by the interested contractors, after which the successful tenderer is made to enter into a contract with the client.

**1.1.2 Integrated procurement systems:** This system involves the integration of the design and construction phases of a project. The design and build procurement approach is the main component of the integrated procurement approach. Design and build (D&B) contracts can be described as a contractual agreement in which the contractor undertakes both to design and to construct a project for a single contract sum. According to Griffith et al.,(2003), the D&B procurement approach is typically described as involving the client entering into an agreement with a party, the principal contractor, who is assigned responsibility for the total project from the initial briefing through to final completion. At the extreme, design and build can

require that the contractor purchase land, obtaining planning permission and consent, finance, design, procure resources and construct. These contracts are known as ‘turnkey’ contracts and derive their name from an employer wanting to have little involvement than simply turning the key to begin the use of the completed project.

**1.1.3 Management oriented procurement systems:** The management oriented procurement approach involves the professionalization of the contractor to the status of consultant, by which he is saddled with the task of managing the activities of the package contractors that are handling the various work sections that make up the whole works. Management contracting, construction management and design & manage are the procurement approaches that are practiced under the management oriented procurement approach.

**1.1.4 Discretionary procurement systems:** The discretionary procurement approach could be described as a framework by which the various procurement approaches can be made use of in order to achieve the client’s specific objectives by imposing the client’s specific management style. These procurement approaches in most situations are not being considered as pure procurement approach as identified in the other forms of procurement approaches, but as a means of controlling and coordinating the project environment in order to achieve the client’s objectives. Examples of procurement approaches that fall under this category include Partnering and the British Property Federation system (BPF).

The D&B procurement approach had been identified to be rapidly growing and patronized in the global construction industry. This is due to the several benefits that the procurement approach provides over the other procurement approaches, most notably the traditional procurement approach, which is characterized by inherent fragmentation which leads to time and cost overruns. D&B procurement approach is different from other procurement approaches; this is due to its advantages of offering single point responsibility, inherent build ability, fixed time and money, and also risk allocation (Gransberg et al., 2006; Seng et al., 2006 and Morledge et al., 2006).

Several authors have attested to the increasing popularity of the D&B procurement approach (Akintoye 1994), (Songer & Molenaar, 1997) and

(Hackett et al., 2007). According to Akintoye (1994), Design and build (D&B) has become a popular mode of procuring construction work. A lot of advantages have been acclaimed for its use even for complex construction work. According to Chan and Yu (2005), D&B procurement approach is one of the new procurement approaches introduced to address the problems associated with the traditional procurement approach; and innovative practices of the D&B procurement approach have been developed to cope with the complexity in both the private and the public sectors. Whilst Hackett et al., (2007) note that D&B has emerged to be the most frequently used procurement approach today, as a recent industry survey for the Royal Institute of Chartered Surveyors noted that approximately 42% of the total value of the projects undertaken was procured as D&B.

In Malaysia, the traditional procurement approach is identified as the most frequently used procurement approach, however, due to the increasing complexity of projects and the growing dissatisfaction of clients towards the use of the conventional procurement approach, D&B is thereby gaining increased popularity and patronage because of the several benefits that the procurement approach provides over the traditional procurement approach (Seng et al., 2006). Although, the last decade has seen most of the construction work implemented using the traditional procurement approach. However in recent years, as projects get more complex, demanding greater emphasis on management techniques and engineering skills, the traditional procurement approach has been found to be unsuitable. It is pointed out by Abdul Rashid (2002), that the lengthy and adversarial nature of the traditional procurement approach and the increase in project complexity has prompted the use of the D&B procurement approach in Malaysia.

## 1.2 Problem Statement

Previous studies by Gransberg et al., (2006), Seng et al., (2006) and Morledge et al., (2006) have identified the various advantages that the D&B procurement approach provides over the other known procurement approaches, which they attribute to the inherent features of the procurement which results in the client benefiting from time and cost savings. However, it is additionally noted by the following researchers that:

(i) Client's expectations in the procurement approach are not adequately met and also the procurement approach is not practiced the ideal way in the Malaysian construction industry (Abdul Rahman et al., 2006), (Seng et al.,2006), (Isa & Hassan, 2011) and (Hashim et al., 2006) as well as

(ii) There seems to be no significant growth of the procurement approach in the Malaysian Construction Industry (Abdul Rashid, 2002).

From the above stated facts, it is evident that D&B is not practiced in its pure form as originally intended, client's expectations are not adequately satisfied in the procurement approach and also the procurement approach has failed to be fully utilized in the Malaysian construction industry. Thereby, *there is the need for a study of the current practice of the system based on **achieving the client's expectations**, which is expected to serve as a clear guideline towards the effective practice and utilization of the procurement approach in the Malaysian construction industry.*

Hence, the issues to be addressed in this study include the following:

- *What are the client's expectations regarding D&B procurement approach in the Malaysian construction industry?*
- *What are the factors that are impeding and also enabling the achievement of these client's expectations?*

### **1.3 Aim of the study**

The aim of the study is to do a critical appraisal of the Design&Build (D&B) procurement approach in the Malaysian Construction Industry based on current practice through identifying the impeding and enabling factors to the achievement of the client's specific expectations system in order to enable the better practice of the D&B procurement approach in the Malaysian construction industry.

### **1.4 Objectives of Study**

- i. To identify the key features / characteristics of D&B procurement approach in the Malaysian construction industry.
- ii. To determine the factors impeding the performance of D&B contractors in achieving client's specific expectations in using D&B procurement approach for building projects in Malaysia.
- iii. To determine the factors enabling the performance of D&B contractors in achieving client's specific expectations in using D&B procurement approach for building projects in Malaysia.

### **1.5 Scope of the Study**

The Scope of the study is focused on both government and non-government projects in the construction industry and is limited to the D&B procurement approach. The target respondents include both clients and contractors. The research strategy is focused on limiting respondents to major clients and G7 (CIDB classification) class of Malaysian contractors.

Note: Features and characteristics literally means the same, as features means the distinguishing trait or quality; while characteristic means the structure, form, or appearance (Webster's dictionary 2011).

## **1.6 Significance of the study**

The study is expected to be of benefit to the industry because, it identifies the underlying client's expectations in using the D&B procurement approach; as well as the factors that enable and also hinder the D&B contractors from achieving these expectations in the Malaysian construction industry. Hence, the study is expected to enable key project stakeholders to determine how to go about effectively implementing the D&B procurement approach in the Malaysian construction industry.

## **1.7 Organization of the thesis**

The Chapter One gives an outline of the background of the study, the problem statement, the aim and objectives of the study, the scope of the study and lastly significance of the study.

While Chapter Two which is the literature review presented gives an overview of the D&B procurement approach. The literature review is aimed at providing the basis for developing the survey instrument necessary to achieve the objectives of the research.

Chapter Three discusses on the research methodology adopted in order to achieve the aim and objectives of the study. The chapter discusses the research procedure adopted for the study, which includes the primary and secondary data collection and how the data collected was analyzed in order to achieve the research objectives.

Chapter Four discusses the results obtained and the findings arising from the analysis conducted, and finally;

Chapter Five discusses the conclusions arrived and also recommendations with respect to the study.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Historical development and the current status of the D&B procurement approach**

The D&B procurement approach is known to have deep historical roots, dating back to the ancient Mesopotamia periods, wherein the master builders were given the sole responsibility for the overall design, engineering and construction of several ancient monuments and structures. Examples of such structures include the Parthenon in Athens, Gothic Royal Abbey Church of Saint Denis, outside Paris and the dome of the Florence Cathedral (Palaneeswaran & Kumaraswamy, 2000).

According to Beard et al., (2001), as time went on, notably during the Renaissance period of the 15<sup>th</sup> century, rise in professionalism in the building industry gave way to the initial adoption of the separation of design and construction. A new perspective that design and construction should be completed by separate groups, which is now known as the traditional method of construction. Additionally, the period of the industrial revolution, which started in the early 18<sup>th</sup> century, was identified with the advent of mechanization, increased need for productivity and specialization in the construction industry, as well as it made a significant impact towards the separation of design and construction.



This fact was further strengthened by the formation of various professional bodies in the late 18<sup>th</sup> century. Such professional bodies include the Institution of Civil Engineers (ICE), the Royal Institute of British Architecture (RIBA), all in Britain; the American Institute of Architects (AIA) and the American Society of Civil Engineers (ASCE) in the United States of America. All these professional bodies were formed with the sole aim of advancing and standardizing the practice of the professionals of the building industry. Then as time went on, particularly after the Second World War, as building structures started becoming more technologically complex, it became apparent that there was a need for more closer collaboration between the designers, building products manufacturers and vendors, thereby the practice of the separation of design from construction evidently was perceived by major clients as an ineffective method of procuring building projects (Beard et. al., 2001). This fact, together with the open dissatisfaction of clients as regards to the inability of the fragmented building procurement system to provide adequate cost, time and quality control on projects, initially led to the advent of the construction management (CM) approach (Beard et. al., 2001).

The CM model offered building owners additional assurances that the designs developed by their Architects and Engineers were, for the most part, practical and cost effective (Beard et. al., 2001). However, the CM process still lacked the single responsibility advantage that clients were longing for, which is regarded as the distinguishing feature of the design and build procurement approach. This led to the experimentation on the use of D&B for the procurement of projects such as school buildings and military housing in the United States towards the end of the 1960's. The main reason for the adoption of the method was to take advantage of the knowledge and experience of the speculative builders so as to be able to shorten the construction period and also to achieve lower costs.

These projects turned out to be a huge success, which thereby led to the widespread adoption of the design and build for the procurement of both public and private projects, which became evident in the 1980's. This fact is attested by Akintoye (1994, p 157), who stated that: "construction enjoyed a boom in the 1980's due to favourable economic and political conditions that produced incentive and encouragement for private sector investment in construction works. This period

witnessed the urgency of clients for early procurement of their building to secure an economic windfall. Coupled with this, the clients were interested in guaranteed lower construction costs. The attributes of D&B fitted those requirements and awareness of the clients”.

Globally, the D&B procurement approach had been growing from strength to strength, as this was evident in the UK construction industry; between the years 1984 and 1991, the use of the system grew from 5% to 15% of all construction projects. At the end of the 1990's, 25% of all construction projects were executed through the D&B system, and furthermore, these projects are known to cover such areas such as housing, industrial, leisure, health, offices and utilities (Anumba & Evbuoman, 1997; Holt et al., 1996; and Ling & Liu, 2004). In the US, a similar trend took place, as by the mid 1990's; more than one third of all construction projects were executed through the D&B approach (Yates, 1995). It is noted by Puerto et al., (2008), that the continuous growth of the procurement approach is expected to continue in the US construction industry. This situation is quite similar as to what is obtained in other parts of the world, as it was reported that D&B is increasingly being adopted as the procurement approach of choice during the construction boom in the middle east, most notably at the United Arab Emirates of Abu Dhabi and Dubai (Bremer, 2007).

So from the above description of the current global trend of the D&B procurement approach, the increasing popularity of the procurement approach is evident, so thereby it is being expected that with respect to this study; the study would go a long way towards providing more insightful views that would further improve the understanding and also practice of the D&B procurement approach globally and also in the Malaysian construction industry in particular.

## 2.2 D&B procurement approach in the Malaysian construction industry

In the case of the Malaysian construction industry, D&B was firstly introduced by the public works department (PWD) in 1983 for the development of the Kuala Terengganu hospital (Abdulrashid, 2002; Seng & Yusuf, 2006), and since then the public sector had continued to lead the way in the adoption of D&B as the procurement approach of choice in the execution of construction projects in

Malaysia. This fact was attested by Abdurrahman, Rahim & Low (2006), where they described the D&B procurement approach to be growing in prevalence with respect to public works in the Malaysian construction industry, and this increased adoption of the procurement approach could be related to the advantages that the approach offers in terms time and cost savings over the known traditional procurement approach. So therefore, in the light of the above, the PWD had continued to be the party responsible for the management of D&B projects in the country. According to Isa et al., (2011) the role that the PWD plays in the executioning of D&B projects in Malaysia is usually that of implementing the project on behalf of the end user from the project inception to commissioning. And in order to do achieve this objective, the following documents are being adopted (i) DB Condition of Contracts, (ii) Guidelines for Management of Design and Build Projects, and (iii) Guidelines for Project Brief Preparation to outline the framework of the project management process. These documents are being adopted in the executioning of D&B projects in Malaysia in order to ensure that the set conditions of contracts that are related to the system are being effectively adopted and moreover to ensure that the D&B projects executed according to the set quality standards.

But then, even with this known increased adoption of the D&B procurement approach in the industry most especially with respect to the public sector projects because of the known advantages that the offers, the procurement approach is still lagging behind in terms of utilization when compared to the traditional procurement approach, and this low utilization covers all aspect of building works adopted in the industry, where with respect to refurbishment works, Ali et al.,(2009) identified that D&B procurement approach covers a mere 25% of all works, with the traditional procurement approach having the majority share. And also same goes with respect to new projects being executed in the industry, as shown in the table below

Table 2.1: Extent of use of procurement approaches (Abdul Rashid 2002, page 126).

Procurement System	Extent of Use		
	Low	Medium	High
Lump sum – drawings and specifications		√	
Lump sum – firm BOQ's			√
Approximate BOQ's		√	
Design and Build	√		
Cost Plus	√		
Management contracting	√		
Construction management	√		

From the table, it could be noted that the with respect to the Malaysian construction industry, the level of adoption of the D&B procurement approach is considered low in comparison to the various forms of the traditional procurement approach.

And moreover, the current practice of the D&B procurement approach in the industry is faced with many such issues which had continued to impede its development and also the ability of the system to effectively achieve the underlying client's expectations in the procurement approach.

Table 2.2: Procurement approaches and time and cost overruns (Abdul Rashid 2002, page 127).

	<b>Traditional</b>	<b>Design and Build</b>	<b>Management contracting</b>
Time overrun	8%	6%	5%
Cost Overrun	8%	4%	1%

Such issues that do affect the current practice of the D&B procurement approach with respect to achieving the client's expectations in a constructed facility includes time and cost overrun, where in the table above, it was shown that the D&B procurement approach does not seem to achieve a considerable time and cost savings with respect to other procurement approaches. This fact was further attested by Hashim et al., (2006) where they attributed the D&B procurement approach as not being able to utilize the cost advantage that the procurement approach offers because of the variations that are being bought up by the clients during the project execution. Another important issue facing the practice of D&B procurement approach in the Malaysian construction industry is that of achieving the quality objective of the D&B projects. Quality is a very important factor which relevance cannot be negated in any form of a constructed facility, as Arditi and Gunaydin (1997) described quality as meeting the legal, aesthetic and functional requirements of a constructed facility, and moreover the project satisfying the basic client's requirements in terms of completion on time, functionality, ease of operation and maintenance and lastly meeting the basic requirements of the regulatory authorities in terms of public safety and health, environmental considerations and protection of public property including utilities. This situation is same with respect to the Malaysian situation, where Idrus et al., (2011) described construction quality as the most important criteria for evaluating project performance in the Malaysian construction industry. This relevance of quality is also same in a project that is executed through the D&B procurement approach, as

Lee et al., (2009) stated that the single point responsibility advantage of D&B could only be utilized when the completed facility had met the minimum requirements in terms of quality.

But then, unfortunately, with respect to the current practice of the D&B procurement approach in the Malaysian construction industry, quality of the constructed D&B projects had continued to be a major source of concern, as most D&B projects executed are being lacking in terms of quality of the constructed facility. This issue was evident from the range of real life cases of failures of projects completed by the use of the D&B procurement approach, as Hashim et al.,(2006) identified, in the year 2006, the government had to rescind its decision of adopting D&B procurement approach for delivering school projects because of cases of lack of quality of the constructed D&B projects which is as a result of the haphazard manner by which the projects were executed by using inferior building materials and also poor workmanship. This situation became more prominent when in the year 2005, a school laboratory collapsed, which this led to a demand by the public to have a change in the procurement approach adopted for executing such school projects. This situation was also same with respect to the use of D&B procurement approach for delivering hospital projects in the country, so thereby, in view of these situations, the government had to order for the review of the D&B procurement approach adopted for all such schools and hospitals projects, most especially with regards to implementing the 9<sup>th</sup> Malaysian plan (2005-2010) (Isa et al., 2011).

Moreover, besides the inability of the D&B procurement approach to attend to the various client's expectations in terms of cost, time and quality, another important issue that tends to impede the development of the procurement approach is the nature of the management structure of the D&B companies in the Malaysian construction industry, where the fragmented approach is the most dominantly adopted in the industry. In the pilot survey conducted in this research, it was found out that the current practice of the D&B approach in the Malaysian construction industry is characterized by the D&B companies outsourcing consultants to execute their projects,

According to Masterman, (2002), this type of management structure is known as the fragmented D&B, it is characterized by the appointment of external design

consultants by the contractor to carry out the designs of the project. These external consultants are co-ordinated by the in-house project managers who manage their activities in order to ensure that the client's interest in terms of project brief and requirements are met. The reason why this type of management structure is adopted is because the D&B contractor believe that it is more economical for them to engage external design consultants than to have in – house, because in the event where these contractors are not involved in any project, then they do not have to engage the services of the external consultants, since the agreement made between the contractor and the external design consultants is only valid for the execution of a particular project. Masterman, (2002), further stated that such management structure is likely to result in too many problems during project execution, because of the structure's inherent separated feature, which makes the system vulnerable to the problems that are associated with the traditional procurement approach.

So therefore, with the above stated facts related to the current practice of the D&B procurement approach in the Malaysian construction industry, that is regarding the low utilization of the procurement approach, to the inability of the procurement approach to effectively satisfy such critical client's expectations in terms of cost, time and also quality, and then the nature of the management structure of the D&B companies, it could then be clearly realized that the procurement approach is faced with several issues with has continued to impede its growth and utilization in the industry, by which this is what this study is aimed at looking into, by which this is expected to provide the much needed stimulus to revamp the practice of the procurement approach , thereby consequently enabling the better practice of the procurement approach in the Malaysian construction industry.

### **2.3 Design and build project delivery method**

Design and build procurement approach (known as design-build in the United States of America) can be considered as a congregation of various procurement approaches which are characterized by their integrated nature. It is a system of building procurement which is characterized by the client entering into a contract with a single contractor who is solely responsible for the design and subsequent construction of a project, whereby the extent of the design carried out by the contractor depends on the variation of the D&B procurement approach used.

Akintoye and Fitzgerald (1995) in their study described D&B as the purchase of a building from a single contractor who is responsible for both design and construction. According to Griffith et al., (2003), they describe D&B approach as a building procurement approach which involves the client entering into an agreement with a party, the principal contractor, who is assigned responsibility for the total project from the initial briefing through to final completion. Whilst for Statham et al., (2007) D&B is a contractual agreement in which the contractor undertakes both to design and to construct a project for a single contract sum. And also, according to Hale and Shrestha (2009 p.579) ‘‘ D&B could be described as a project delivery method in which the owner provides requirements for the specified project and awards a contract to one company who will both design and build the project. Therefore, there is only one procurement step to select one entity to complete the project, and one contract between the owner and this entity’’.

CIOB (1988) gives a comprehensive definition of the design and build procurement approach which has the client dealing directly with the contractor for the complete building and it is the contractor who is not only responsible for, but also coordinates the separate design and construction processes, including engagement of the design team who are, therefore, contractually linked with the contractor and the client. The construction process, whilst linked, is still separate from the design process, leaving the consultants free to concentrate on their own roles. The client may, however, directly appoint either in-house staff or a separate consultant to check that the



product the contractor is providing is value for money and that content and quality are satisfactory, and also meets his needs and expectations.

As Khalil (2002,p 470) put it, ‘‘In D&B, the owner contracts with a single entity design and construction. The approach can eliminate the adversarial relationship in the traditional approach because a single entity is responsible for both design and construction. It can also reduce the overall time of project completion and permits the incorporation of constructability information during design’’. Furthermore according to Ratnasabathy and Rameezdeen (2007), D&B is a method of project delivery that facilitates innovative and flexible approaches such as phased construction, improves the ability to manage risk because there is a single point of responsibility, allows managers to take advantage of new materials and new technologies, and encourages the development of development of innovative practices that support energy efficiency and sustainability.

From the above definitions regarding the D&B procurement approach, it can be generally understood that the underlying principle behind the procurement approach is that the client is known to enter into a contract with a D&B contractor who is responsible for the bespoke design and construction of a project. Akintoye (1994) suggests that there are a few variations of D&B procurement approach, which includes the following six:

(a) **Traditional design and build:** This is regarded as the conventional or pure type of design and build procurement approach, where the contractor is totally responsible for the overall design and construction in order to meet the requirements and needs of the client. According to Knight et al., (2002) this type of design and build is characterized by the contractor being involved in the early stages of the project, where the conceptual designs are being made then subsequently proceeding to project execution in accordance to the requirements of the client.

(b) **Package deal:** In this type of D&B, the contractor provides the client with standard or system buildings which are specifically tailored to meet the client’s space and functional requirements. The main idea behind this design and build variant is that it enables the client to purchase a packaged building product which readily satisfies his building needs in a speedy and economical manner.

The majority of package deal contractors, by their virtue of providing packaged buildings, do have their own in-house designers, which enables them to produce the buildings within a shorter time frame. According to Masterman (2002), in buildings that are being produced by the package deal form, some of them do lack aesthetic appeal, but then, this problem can be avoided by the client seeing prototypes of the contractor's product before making a decision.

(c) **Design and manage:** This involves the contractor being responsible for the design and the subsequent supervision of the activities of the various subcontractors who are handling the various work sections that make up the whole works. But then, here unlike in the case of the traditional procurement approach, the contractors are being paid a fee for their management services.

(d) **Design, manage and construct:** This variation of the D&B is similar to the Design and Manage, but only that in this case, the contractor is responsible for designing and managing, in addition to constructing the facility.

(e) **Novation Design and build:** This is that type of design and build where the client initially employs a design consultant, who carries out the initial designs and all the proper documentation up to the extent that the client's needs are being clearly fulfilled, after which, the design consultant is novated (passed on) to the appointed contractor who has the responsibility of executing the project through further design and construction activities.

Neveen and Greenwood (2009) described the novated D&B as a rapidly growing form of D&B procurement approach, by which as at 2004, this variation of the D&B accounts for 25% of the value of all proposed construction projects in the UK. In the novation process of novated design and build, responsibility to the client is being transferred from the design consultant to the appointed contractor, and the novation process usually takes place after the design consultant has carried out the designs to a sufficient clear level that would enable prospective contractors to present a realistic bid for the project (Skitmore & Ng, 2002). It is a type of tri-party agreement between clients, consultants and contractors, which are often structured in such a way that

they will bring an end to existing original terms of engagement between clients and consultants, and create a new form of agreement between consultants and contractors (Abrahams & Farell, 2003).

In the pre-novation stage of a novation design and build, the client enters into a contract with design consultant to carry out the designs of the proposed project to a stage where all the clients requirements are clearly identified, by which the designs range from 30-80% of the overall design requirements, then on the basis of this initial designs and documentation, contractors are invited to tender for the project. In the pre-novation stages of this procurement approach, the contractual agreement between the client and the designers is similar to that in the traditional procurement approach (Ogunlana 1999).

In the pre-novation stage, the client is responsible for paying for the services rendered by the designers. Whilst the post-novation stage of the 'novation design and build' involves the transfer of the designer's rights and responsibilities to the selected contractor, where the designer now is required to produce all the outstanding information (mainly drawings) that is required for the execution of the project. Hence, in the post-novation stage, the contractor now becomes responsible for paying for the services rendered by the designer.

## 2.4 Characteristics of D&B procurement approach

D&B is a procurement approach which is generally characterized by the client entering into a contract with a single organization who has the responsibility for the overall design and construction of a project.

It is a system which is characterized by a wide range of inherent features which makes it distinct from the other known procurement methods. Characteristics of the D&B procurement approach, includes the following:

(a) **Single point responsibility:** Single point responsibility is being considered as the most distinguishing feature of the D&B procurement approach. The D&B procurement approach involves the client entering into a contract directly with the contractor without any mediating consultant, and the contractual position of the

project lies solely between the client and the contractor (Seng & Yusuf 2006). The origin of the single point responsibility feature of the D&B procurement approach could be traced to the nature of some industries which are characterized by the manufacturer being responsible for providing one stop solution to its clients, ranging from facility design, and equipment selection to the adoption of the most suitable method in order to produce a required product (Beard et al., 2001).

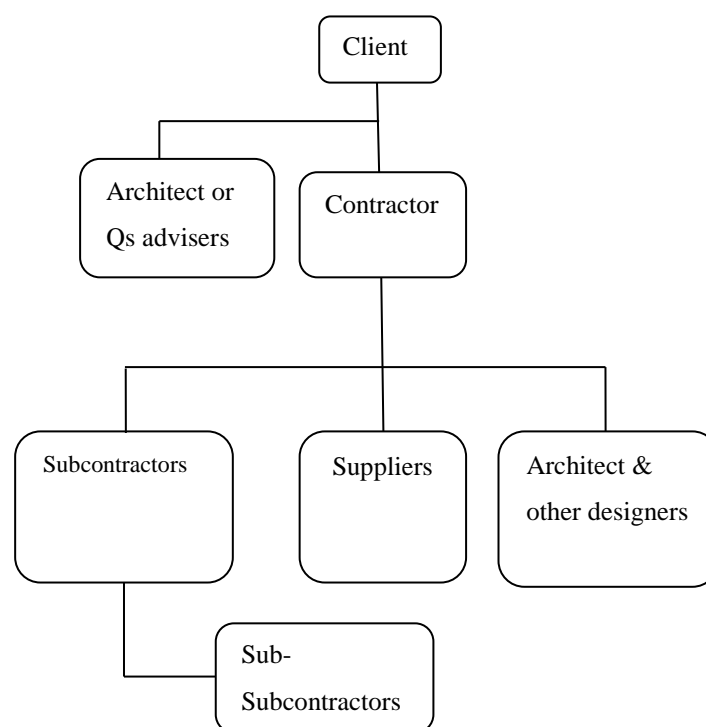


Fig.2.1: Contractual relationship under D&B procurement approach (Morledge et al., 2006 p.118)

The single point responsibility nature of the D&B procurement approach makes the contractor completely liable for the performance of the completed project, even though any such problem or faults that emerge related to the completed project could be caused by the activities of the subcontractors that were involved in the construction process. This could be attributed to the fact that, in the D&B procurement approach, the contractor is known to be liable for all the contractual

obligations and activities of subcontractors and suppliers that are involved in the D&B project.

(b) **Complexity:** The D&B is a procurement approach which is mostly adopted for use in large and complex projects. It is a procurement approach whose growing adoption by clients could be attributed to the lengthy and adversarial nature of the traditional procurement approach and also due to the growing complexity of today's construction projects (Abdul Rashid, 2002; Chan & Yu, 2005). Due to this fact, the system is mostly adopted for use in projects that are complex in nature, which necessitates the greater need for the effective planning of the D&B project from the onset in order to achieve a successful project execution. There is the need for the expert counsel of a consultant who can be in-house or could be outsourced, who is saddled with the responsibility from the project onset of carefully guiding the client towards effectively articulating his needs, to assist the client towards carefully evaluating the various proposals submitted by the bidding D&B contractors, and also to monitor the subsequent design development and the eventual construction of the project (Beard et al., 2001).

(c) **Risk allocation:** Risk has been defined as the probability of occurrence of some uncertain, unpredictable and even undesirable events that could change the prospects for the profitability on a given investment (Hassim et al., 2008). D&B is a building procurement approach which is known to transfer to the contractor risks that are associated to the project more than any other procurement approach (Muhammed, 2005).

The risk allocation nature of the D&B procurement approach could largely be attributed to its single point responsibility nature, where the D&B contractor is required to be in total responsibility of not only the design, but also the construction phases of the contract (Beard et al., 2001).

(d) **Compressed delivery schedule:** The D&B procurement approach is characterized by having a schedule for delivering the construction project in a compressed manner, by which actual construction can be started even before the

## REFERENCES

- Abdul Rahman, H., Rahim, F.A.M., & Low, W., 2006. A study on the quality management during the pre-construction stage of design and build projects. In *Quantity Surveying National Conference*. Kuala Lumpur, 2006.
- Abdulrashid, K., 2002. *Construction Procurement in Malaysia*. Kuala Lumpur: IIUM Press.
- Abrahams, K. & Farell, P., 2003. An Investigation into the Influence of Design and Build Procurement Methods on Client Value for Money. *Journal of Construction Management and Engineering* , 23(5), pp.67-75.
- Adnan, H., Jusoff, K. & Salim, M., 2008. The Malaysian Construction Industry Risk Management. *Modern Applied Science*, 2(5), pp.27-33.
- Akintoye, A., 1994. Design and Build: a survey of construction contractors views. *Construction Management and Economics*, 12, pp.155-63.
- Akintoye, A. & Fitzgerald, E., 1995. Design and build: a survey of architects views. *Engineering, Construction and Architectural Management*, 2(1), pp.27-44.
- Akintoye, A.S. & Macleod, M.J., 1997. Risk analysis and management in construction. *International Journal Of Project Management*, 15(1), pp.31-38.
- Al Rashid, K. & Kartam, N., 2005. Design–build pre-qualification and tendering approach for public projects. *International Journal Of Project Management*, 23(4), pp.309-20.
- Ali, S.A., Kamaruzzaman, S.N. & Salleh, H., 2009. The Characteristics of Refurbishment Projects in Malaysia. *Malaysia Facilities*, 27(2), pp.56-65.

- Alin, V., Riatri, L.S. & Trigunaryah, B., 2006. Corrective Action Recommendation for Project Cost Variance in Construction Management. In *The tenth East Asia Conference on Structural Engineering and Construction*. Bangkok, 2006.
- Al-Momani, A.H., 2000. Examining Service Quality within the Construction Process. *Technovation*, 20(3), pp.643-51.
- Amaratunga, D., Baldry, D., Sarshar, M. & Newton, R., 2002. Quantitative and Qualitative Research in The Built Environment. *Emerald*, 51(1), pp.17-30.
- Anumba, C.J. & Ebuoman, N.F.O., 1997. Concurrent Engineering in Design - Build Projects. *Construction Management and Economics*, 15(4), pp.271-81.
- Arditi, D. & Gunaydin, H.M., 1997. Total quality management in the construction process. *International Journal of Project Management*, 15(4), pp.235-43.
- Bahar, J.F. & Crandall, K.C., 1990. Systematic Risk Management Approach for Construction Projects. *Journal Of Construction Management & Engineering*, 116(3), pp.533-46.
- Bajaj, D., Oluwoye, J. & Lenard, D., 1997. An analysis of contractors' approaches to risk identification in New South Wales, Australia. *Construction Management and Economics*, 15(4), pp.363 - 369.
- Baker, S., Ponniah, D. & Smith, S., 1999. Risk response techniques employed currently for major projects. *Construction Management and Economics*, 17(2), pp.205 - 213.
- Baldry, D., 1998. The evaluation of risk management in public sector capital projects. *International Journal Of Project Management*, 16(1), pp.35-41.
- Beard, J., Loulakis, M. & Wundram, E., 2001. *Design-build: Planning through development*. 1st ed. Newyork: Mc Graw Hill.

- Belassi, W., 1996. A New Framework for Determining Critical Success/Failure Factors in Projects. *International Journal of Project Management* , 14(3), pp.141-51.
- Bell, L.C. & Stukhart, G., 1987. Costs and Benefits of Materials Management systems. *Journal of Construction Engineering and Management*, pp.222-34.
- Best, R. & Devalance, G., 2002. *Design and Construction : Building in Value*. 1st ed. Oxford: Butterworth-Heinemann.
- Bremer, B., 2007. *The Race for the tallest Skyscraper*. Newspaper Report. Dubai : Business Week Online.
- Bubshait, A.A., 1994. Owner Involvement in Project Quality. *International Journal of Project Management*, 12(2), pp.115-17.
- Building, C.I.o., 1988. *The Chartered Institute of Building Design and Build Code of Estimating Practice Supplement*. London: Chartered Institute of Building, UK Chartered Institute of Building, UK.
- Cavalli, S. & Ortolano, A., 2004. Delphi Forecast of Land Use - Transportations interactions. *Information and Management*, 42(2), pp.15-29.
- Chan, A.P.C. & Chan, D.W.M., 2003. A Benchmark Model for Construction Duration in Public Housing Developments. *International Journal of Construction Management*, pp.1-14.
- Chan, A.P.C. & Chan, D.W.M., 2004. Developing a Benchmark Model for Project Construction Time Performance in Hong Kong. *Building and Environment*, 39(5), pp.339-49.
- Chan, A.P.C., Ho, D.C.K. & Tam, C.M., 2001. Design and Build Project Success Factors: Multivariate Analysis. *Journal of construction engineering and management*, 127(2), pp.93-100.



- Chan, D.W.M. & Kumurawasanmy, M.M., 2002. Comparison of US Project Delivery Systems. *International Journal Of Project Management*, 20(1), pp.23-55.
- Chan, A.P.C, Yung, E.H.K, Lam,P.T.I, Tam, C.M & Cheung,S.O., 2001. Application of Delphi method in selection of procurement systems for construction projects. *Construction Management and Economics*, 19(1), pp.699-718.
- Chan, A.P.C & Scott, D.C.A.P.L., 2004. Factors Affecting the Success of a Construction Project. *Journal of Construction Engineering and Management*, 130(1), pp.I53-155.
- Chan, A.P.C, Scott, D. & Lam, E.W.M., 2002. Framework of Success Criteria for Design/Build Projects. *Journal of Engineering in Management*, 18(3), pp.120-28.
- Chan, E. & Yu, A., 2005. Contract Strategy for Design Management in the Design and Build System. *International Journal Of Project Mangement* , 23(3), pp.630-39.
- Chan, A.P.C. et al., 2001. Application of Delphi method in selection of procurement systems for construction projects. *Construction Management and Economics*, 19(1), pp.699-718.
- Chan, A.P.C & Xia, B., 2010. Key Competences of Design and Build. *Journal of Facilities Management*, 8(2), pp.114-29.
- Chitu, O. & Pawlowski, S.D., 2004. The Delphi method as a research tool: an example,design considerations and applications. *Information & Management*, 42 , p.15–29.

- Construction Industry Development Board, 2007. *Construction Industry Master Plan 2006-2015*. Master plan report. Kuala Lumpur: Construction Industry Development Board.
- Construction Industry Development Board, 2010. [Online] Available at: [www.cidb.gov.my](http://www.cidb.gov.my) [Accessed April 2010].
- Critcher, C. & Gladstone, B., 1998. Utilizing the Delphi Technique in Policy Discussion: A case study of a Privatized Utility in Britain. *Public Administration*, 76(3), pp.431-50.
- Cronin, J.J. & Taylor, S., 1992. Measuring Service Quality: A Re-examination of the Extensions. *Journal of Marketing*, 56(3), pp.55-69.
- Dainty, A.R.J., Cheng, M. & Moore, D.R., 2003. Redefining Performance Measures for Construction Project Managers: An Empirical Evaluation. *Construction Management and Economics*, 21(4), pp.209-18.
- Day, J. & Bobeva, M., 2005. A Generic Tool kit for the successful management of delphi studies. *The Electronic journal of Business Research Methodology*, 3(2), pp.103-16.
- De Leeuw, E.D., 2005. To Mix or Not to Mix Data Collection Modes in Surveys. *Journal Of Official Statistics*, 21(2), pp.233-55.
- Dey, P.K. & Ogunlana, S.O., 2004. Selection and application of risk management tools and techniques for build-operate-transfer projects. *Industrial Management & Data Systems*, 104(4), pp.334-46.
- Doke, E.R. & Swanson, N.E., 1995. Decision variables for selecting prototyping in information systems development: a Delphi study of MIS managers. *Information & Management*, 29, pp. 173-182.
- El- Sawalhi, N., Eaton, D. & Rustom, R., 2007. Contractor Pre-qualification Model. State of the Art. *International Journal Of Project Management*, 25(4), pp.465-74.

- El Wardani, M.A. & Messner, J.I.J., 2005. Comparing Procurement Methods for Design-Build Projects. *Journal Of Construction Engineering and Management*, 132(3), pp.230-39.
- Fergusson, H. & Clayton, L., 1988. Quality in the Constructed Project: A Guidance For Owners, Designers and Constructors. *ASCE*, 23(3), pp.45-53.
- Franks, J., 1998. *Building procurement systems: a client's guide*. 3rd ed. London: Longman.
- Fredrickson, K., 1998. Design Guidelines For Design and Build Projects. *Journal of Management and Engineering*, 14(1), pp.77-80.
- Gransberg, D.D., 1999. Design - Build Contract Award Methods Transportation Projects. *Journal of Transportation Engineering* , 125(6).
- Gransberg, D.D & Barton, R.F., 2007. Analysis of Federal Design - Build Request for Proposal Evaluation Criteria. *Journal of Management in Engineering*, 23(2).
- Gransberg, D., Koch, J. & Molenaar, K., 2006. *Preparing For Design And Build Projects*. 1st ed. New York: ASCE.
- Gransberg, D., Koch, J.A. & Molenaar, K.R., 2006. *Preparing For Design-Build Projects (A primer for owners, engineers and contractors)*. Virginia: ASCE Press.
- Gransberg, D.D. & Molenaar, K., 2004. Analysis of Owner's Design and Construction Quality Management Approaches in Design/Build Projects. *Journal Of Management in Engineering*, 20(4), pp.162-69.
- Griffith, A., Knight, A & King, A., 2003. *Best Practice Tendering for Design and Build Projects*. 1st Edition ed. London: Thomas Telford.
- Hackett, M., Robinson, I. & Statham, G., 2007. *The Aqua Guide To Procurement, Tendering & Contract Administration*. Oxford: Blackwell Publishing.

- Hale, D.R. & Shrestha, P.P., 2009. Enirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods. *Journal of Construction Engineering and Management*, 135(7), pp.578-87.
- Hashim, M. et al., 2006. Factors Influencing the Selection of Procurement System by Clients. In *International Conference on Construction Industry*. Padang, Indonesia, 2006.
- Hashim, M. et al., 2006. Effect of Procurement Systems on the Performance of Construction Projects. In *International Conference on Construction Industry*. Padang, 2006.
- Hashim, M. et al., 2006. Factors Influencing the Selection of Procurement Systems by Clients. In *International Conference on Construction Industry*. Padang, Indonesia, 2006.
- Hassim, S., Sazalli, S.A.A. & Jaafar, M.S., 2008. Identification of Sources of Risk in IBS Project. *European Journal of Social Sciences*, 6(3), pp.315-24.
- Holt, G.D., Olomolaiye, P.O. & Harris, F.C., 1996. Tendering procedures, contractual arrangements and Latham: the contractors' view. *Engineering, Construction and Architectural Management*, 3(2), pp.97-115.
- Huang, T., Shen, L.Y., Yam, C.H. & Zhao, Z.Y., 2005. An Analysis to the Existing Practice of Managing Government-Invested roject in China. *Construction Economics*, pp.16-20.
- I.O.B, 1979. *Contractor Selection - A Guide to Good Practice*. Ascot: Institute of Building Institute of Building.
- Idrus, A., Sodangi, M. & Husin, M.H., 2011. Prioritizing Project Performance Criteria within Client Perspective. *Research Journal of Applied Sciences*, 3(10), pp.1142-51.
- Isa, H.M. et al., 2011. Learning from Defects from Defects in Defects and Build Hospitals in Malaysia. In *International Conference on Social Science and Humanity*. Singapore , 2011. IACSIT Press.

- Kandampuli, B., 2003. B2B Relationships and Networks in the Internet Age, a Management Decision. *Strategic Management Journal*, 41(5), pp.443-51.
- Kangari, R., 1995. Risk Management Perceptions and Trends of U.S Construction. *Journal of Construction Engineering and Management*, 121(4), pp.422-29.
- Kartam, N.A. & Kartam, S.A., 2001. Risk And Its Management In The Kuwaiti Construction Industry: A Contractors Perspective. *International Journal Of Project Management*, 19(1), pp.325-35.
- Kashiwagi, D. & Byfield, R.E., 2002. Selecting the best contractor to get performance: On time, on budget, meeting quality expectations. *Journal of Facilities Management*, 1(2), pp.103-1116.
- Kelly, B.E.S., Haskins, S. & Reiter, P.D., 1998. Implementing a D.B.O Project. *Journal Of American Water Works Association* , 90(6), pp.34-46.
- Khairuddin, A., 2002. *Construction procurement in Malaysia*. 1st edition ed. Kuala Lumpur, Malaysia: International Islamic University Of Malaysia.
- Khalil, M.I., 2002. Selecting the Appropriate Project Delivery Method Using AHP. *International Journal of Project Management*, 20(5), pp.469-74.
- Knight, A.D., Griffith, A. & King, A.P., 2002. Supply side short-circuiting in design and build projects. *Management Decision*, 40(7), pp.655-62.
- Konchar, M. & Sanvido, V., 1998. Comparison of U.S. Project Delivery Systems. *Journal Of Construction Engineering and Management*, 124(6), pp.435-45.
- Lam, E.W.M., Chan, A.P.C. & Chan, D.W.M., 2004. Benchmarking design-build procurement systems in construction. *Benchmarking: An International Journal*, 11(3), pp.287-302.
- Lam, E.W.M., Chan, A.P.C. & Chan, D.W.M., 2004. Benchmarking design-build systems in construction. *Benchmarking: An International Journal*, 11(3), pp.287-302.

- Lam, E.W.M., Chan, A.P.C. & Chan, D.W.M., 2008. Determinants of Successful Design-Build Projects. *Journal of Construction Engineering and Management*, 134(5), pp.333-41.
- Latham, M., 1994. *Construction the Team*. London : Her Majesty Office.
- Lee, D., Lima, T. & Arditi, D., 2009. Automated Stochastic Quality Function Deployment System for Measuring the Quality Performance of Design/Build Contractor. *Automation in Construction* , 18(4), pp.348-57.
- Levy, S., 2006. *Design and Build: Project Delivery*. New - York: Mc Graw - Hill.
- Ling, F. Y.Y., 2002. A Case Study on the Management of the Development of a Large Scale Power Plant Project in East Asia based on Design-Build Arrangement. *International Journal of Project Management*, 20(6), pp.413-23.
- Ling, F.Y.Y., Chong, E. & Ee, L.P., 2004. Predicting Performance of Design-Build and Design-Bid-Build Projects. *Journal of Construction Engineering and Management*, Vol. 130(No. 1), pp.75-83.
- Ling, F.Y.Y., 2003. Managing the Implementation of Construction Innovations. *Construction Management & Economics*, 21(6), pp.635-49.
- Ling, F.Y.Y., 2004. How project managers can better control the performance of design-build projects. *International Journal of Project Management*, 22(1), pp.477-88.
- Ling, F.Y.Y., Chan, S.L., Chong, E. & Ee, L.P., 2004. Predicting Performance of Design-Build and Design-bid-build Projects. *Journal of Construction Engineering and Management*, 130(1), pp.75-83.
- Ling, F.Y.Y. & Liu, M., 2004. Using neural network to predict performance of design-build. *Building and Environment*, 39, p.1263 – 1274.
- Ling, F.Y.Y. & Poh, B.H.M., 2008. Problems encountered by owners of design – build projects in Singapore. *International Journal of Project Management* , 26(1), pp.164-73.

- Loo, R., 2002. The Delphi Method: A powerful tool for strategic Management. *Policy: An international Journal of Police Strategies and Management*, 25(4), pp.762-69.
- Ludwig, B., 2001. Predicting the Future: Have you Considered Using the Delphi. *Journal of Extension* , 35(5), pp.43-52.
- Luu, D.T., Ng, T. & Swee, E.C., 2003. A Case Based Procurement Advisory System for Construction. *Advances in Engineering Software*, 34(7), pp.429-38.
- Martino, J., 1973. *Method of Technological Forecasting*. New York: Gordon and Breach Science.
- Masterman, J., 2002. *Introduction to building procurement systems*. London: Spon Press.
- Memon, N.A., Abro, Q.M.A. & Mugheri, F., 2011. Quality Management in the Design and Construction Phase: A Case Study. *Mehran University Research Journal Of Engineering & Tecnology* , 30(3), pp.50-61.
- Miles, M.B. & Huberman, A.M., 1994. *Qualitative Data Analysis*. 2nd ed. California: Sage Publications.
- Mills, A., 2001. A Systematic Approach to Risk Management for Construction. *Structural Survey*, 19(5), pp.245-52.
- Moller, A. & Picker, P.S., 2005. E- Commerce Adoption in Developing Countries : A Model and Instrument. *Information & Management Journal* , 42(7), pp.877-99.
- Moore, D.R. & Dainty, A.R.J., 2001. Intra-team Boundaries as Inhibitors of Performance Improvement in UK Design and Build Projects: A Call for Change. *Construction Management and Economics*, 19(2), pp.559-62.
- Molenaar, K.R. & Gransberg, A.D., 2001. Design-Builder Selection for Small Highway Projects. *Journal of Management in Engineering*, 17(4), pp.214-24.

- Molenaar, K.R., Songer, A.D. & Barash, M., 1999. Public-sector design/build evolution and performance. *Journal of Management in Engineering*, 15(2), pp.54-62.
- Morledge, R., Kashiwagi, D & Smith, A., 2006. *Building Procurement*. 1st ed. Oxford: Blackwell Publishing..
- Muhammed, N.H., 2005. *A Case Study on the Management of UTM New Hostel Based on Design and Build Arrangement*. Msc Thesis. Johor: Universiti Teknologi Malaysia.
- Mullen, P.M., 2003. Delphi: myths and reality. *Journal of Health Organization and Management*, 17(1), pp.37-52.
- Nau, D., 1995. Mixing methodologies: Can Bimodal Research be a Viable Post-Positivist Tool ? *The Quantitative Report Online Serial*, 2(3), pp.50-62.
- Ndekugri, I. & Turner, A., 1994. Building Procurement by Design and Build. *Journal of Construction Engineering and Management*, 120(4), pp.243-56.
- Neveen, H. & Greenwood, D., 2009. Energy Conservation Regulations: Impacts on Design and Procurement of Low Energy Buildings. *Building and Environment* , 44(5), pp.929-36.
- Nguyen, L.D., Ogunlana, S.O. & Lan, D.T.X., 2004. A study on Project Success Factors in Large Construction Projects in Vietnam. *Engineering, Construction and Architectural Management*, 11(6), pp.404-13.
- Ogunlana, S., 1999. *Profitatble Partnering in Construction*. New york: E & F Spon.
- Okoli, C. & Pawlowski, S.D., 2004. The Delphi method as a research tool: an example, design considerations and applications. *Information & Management*, 42, pp.15-29.
- Okoli, C. & Suzanne, D., 2004. The Delphi Method as a Research Tool: Am Example, Design Considerations and Applications. *Information & Management*, 42(3), pp.15-29.



- Opdenakker, R., (2006). Advantages and Disadvantages of Four Interview Techniques in Qualitative Research. *Forum: Qualitative Social Research*, 7(4).
- Osipova, E., 2008. *The Impact of Procurement Options on Risk Management in Swedish Construction Projects*. Phd Thesis. Lulea: Luleå University of Technology.
- Oztas, A. & Okmen, O., 2004. Risk Analysis in Fixed-Price Design-Build Construction Projects. *Building and Environment*, 39(1), pp.229-37.
- Paek, J.H., Lee, Y.W. & Napier, T.R., 1992. Selection of Design/ Build Proposal Using Fuzzy-Logic System. *Journal of Construction Engineering and Materials* , 118(2), pp.675-84.
- Palaneeswaran, E. & Kumaraswamy, K., 2000. Contractor Selection for Design/Build Projects. *Journal of Construction Engineering and Management*, 126(5), pp.331-39.
- Parfitt, M.K. & Sanvido, V., 1992. Critical Success Factors for Construction Projects. *Journal Of Construction Engineering and Management*, 118(1), pp.94-111.
- Parfitt, M.K. & Sanvindo, V.E., 1993. Checklist of Critical Success Factors for Building Projects. *Journal of Management in Engineering*, 9(3), pp.243-49.
- Peterson, D.R. & Murpheree, E.L., 2004. The Impact of Owner Representatives in a Design-Build Construction Environment. *Project Management Journal*, 35(3), pp.27-38.
- Phillips, R., 2000. New Application for the Delphi Technique. *Annual San Diego*, 2(1), pp.27-34.
- Pockock, J.B. et al., 1996. Relationship between project interaction and performance indicators. *Journal of Construction Engineering and Management*, 122(2), pp.165-76.

- Potter, K.J., 1994. *A Design and Build Prequalification System*. Technical Report. Pennsylvania: The Pennsylvania State University.
- Puerto, C.L., Gransberg, D.D. & Shane, J.S., 2008. Comparative Analysis of Owner Goals for Design and Build Projects. *Journal of Management in Engineering*, 24(1), pp.32-39.
- Ratnasabathy, S. & Rameezdeen, R., 2007. A Decision Support System for the Selection of Best Procurement System in Construction. *Built Environment*, 7(2), pp.151 - 160.
- Rocco, T., Bliss, L., Gallagher, S. & Prado, L., 2003. Mixed Methods research in Organizational Systems. *Information Technonology, Learning and Performance Journal*, 21(1).
- Rockhart, J.F., 1982. The Changing Role of the Information Systems: A Critical Success. *Sloan Management Review*, 24(1), pp.3-13.
- Russell, J.S., 1996. *Constructor Prequalification: Choosing the best contractor and avoiding constructor failure*. USA: ASCE Press.
- Saunders, M., Lewis, P.H. & Thornhill, A., 2007. *Research Methods For Business Students*. 4th ed. New York: Prentice Hall.
- Seng, N, Y. & A, 2006. The Success Factors of Design and Build Procurement Method. In *6TH Asia - Pacific Structural and Construction Conference*. Kuala Lumpur, 2006.
- Shenhar, A.J., Levy, O. & Dvir, D., 1997. Mapping the dimension of project success. *Project Management Journal* , 28(2), pp.5-13.
- Skitmore, M. & Ng, T., 2002. Contractors Risks in Design, Novate and Construct contracts. *International Journal Of Project Management*, 20(2), pp.119-126.

- Shore, B., 1998. IT Strategy : The Challenge of Over Triangulation, Culture, and Large Scale Colloborations. *Journal of Global Information Technology Management* , 1(1), pp.46-53.
- Sohail, M. & Baldwin, A.N., 2004. Performance Indicators for "Micro-Projects" in Developing Countries. *Construction Management and Economics*, 22(3), pp.11-23.
- Songer, A. & Molenaar, K., 1996. Selecting Design-Build: Public and Private Sector Owner Attitudes. *Journal of Management in Engineering*, 12(6), pp.47-53.
- Songer, A.D. & Molenaar, K.R., 1997. Project Characteristics for Successful Public-Sector Design and Build. *Journal of Construction Engineering and Management*, 123(1), p.40.
- Songer, A.D. & Pecsok, R.S., 1997. Risk Analysis for Revenue Dependent Infrastructure Projects. *Construction Management and Management* , 15(4), pp.377-82.
- Statham, G., Robinson, I. & Hackett, M., 2007. *The Aqua Group Guide to Procurement, Tendering and Contract Administration*. Oxford: Blackwell Publishing.
- Stone, F.L. & Busby, D.M., 1996. *The Delphi Research Methods in Family Therapy*. Newyork: Guildford.
- Sweiss, G., Sweiss, R., Hammad, A.A. & Shboul, A., 2008. Delays in construction projects: The case of Jordan. *International Journal of Project Management*, 26 (1), pp.665-74.
- Takim, R. & Akintoye, A., 2002. Performance Indicators for Successful Construction Project Performance. In *18th Annual ARCOM Conference*. Nothumbria, 2002. University of Northumbria.
- Topeu, Y.I., 2004. A Decision Model Proposal for Construction Contractor Selection in Turkey. *Building Environment*, 39(3), pp.469-81.

- Walker, C. et al., 1995. *Privatized Infrastructure*. London: Thomas Telford.
- Walker, A.M. & Selfe, J., 2000. The Delphi Method: A Useful Tool for the Allied Health Researcher. *British Journal of Therapy and Rehabilitation*, 3(12), pp.677-80.
- Wang, S.Q., Dulaimi, M.F. & Aguria, M.F., 2004. Risk management framework for construction projects in developing countries. *Construction Management and Economics*, 22(3), pp.237-52.
- Webster's Dictionary 2011. Retrieved April, 25 2011 from <http://www.merriam-webster.com/dictionary/>
- Xia, B. & Chan, A.P.C., 2010. Key Competences of Design and Build. *Journal of Facilities Management*, 8(2), pp.114-29.
- Xiao, H., 2002. The Performance of Contractors in Japan, the US and the UK, an evaluation of construction Quality. *International Journal of Quality & Reliability Management*, 19(6), pp.672-87.
- Xu, T. & Wang, Y.Q., 2003. Analysis for Selecting the Most Appropriate Procurement System in Construction Projects. *Jiaotong University Journal of Social Sciences* , 23(1), pp.32-39.
- Yates, J.K., 1995. Use of Design/Build in E/C Industry. *Journal of Management in Engineering*, 11(6), pp.33-38.
- Yongqiang, C., Xingyu, Z. & Ning, Z., 2009. Comparison of Project Objectives and Critical Factors between DBB and DB in China. *Industrial Engineering and Innovation* , 3(5), pp.231-40.
- Youssuf, M.I., 2007. Using Experts Opinion Through Delphi Technique. *Practical Assesment, Research and Evaluation*, 12(4), pp.16-24.