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THE SUCCESS FACTORS OF DESIGN AND BUILD PROCUREMENT METHOD: A LITERATURE VISIT

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ABSTRACT: Studies on project procurement techniques are normally focus on the ability of the techniques to manage risk in projects undertaking. The shifting from traditional to innovative procurement approach is resulted from the complexity of project nowadays. Design and Build which is on one the innovative techniques, has gained popularity from the time and cost saving reputation. The basic concept of Design and Build require the project to be contracted to a single organization that would be responsible for design, procurement, engineering and commissioning. This paper aims to theoretically explore and reveal the effectiveness of Design and Build in procuring the project. The paper shows that characteristics of Design and Build that make it different from other procurement system nested in the advantages of offering single point responsibility, fixed time and money, communication and risk allocation. Proper exploitation of these characteristics may lead to the success of the system.

Keywords: Procurement, Design and Build, Key success factors.

1.0 INTRODUCTION

A common trend in Malaysia construction industries, particularly for large mega projects, is adopting the Design and Build procurement method such as Twin Petronas Tower, Kuala Lumpur International Airport, Malaysia North South Highway, Penang Bridge and etc.,. Design and Build contract is widely used recent years for the project delivery. The basic concept of Design and Build approach is for the organisation requiring the project to be contracted with a single organisation that would be responsible for design, procurement, engineering and commissioning. Literally, all the client would have to do would be 'to turn a key in the door' and the project would be in operation readiness.

In Malaysia, the last decade has seen most of the construction projects have been implemented using the traditional procurement method. But in recent years, as project get more complex which demand greater emphasis on management techniques and engineering skills, the traditional procurement approach was found not suitable to the current needs. Design and Build procurement method is an alternative to traditional method which is rapidly popular in Malaysia, especially in the public sector. Design and Build acclaimed to be beneficial to all parties such as clients, architect, engineers and contractors (Gwen, et. Al 1998).

The Design and Build system was first launched in the Public Works Department by the Malaysia Prime Minister in 1983. The first project handled by this unit was the Kuala Terengganu Hospital, which was completed in 1985 (Mokhtar 1993). The Design and Build system contains three elements which are fundamentally characterised with single responsibility to a particular organization, reimbursement is generally by means of a fixed-price lump sum and the project is designed and built specially to meet the needs of the client. As the client dissatisfied with the performance of conventional methods of project delivery, the integration of Design and Build could lead to saving in time and fixed price lump sum tenders could be obtained was extremely attractive. These heavily contractor-marketed characteristics ensure the growth in use of the Design and Build system and in turn produced one of the most significant trends in construction delivery in recent years.

The Design and Build construction process has been part of the construction industry. Today, the process is growing rapidly in this industry. As it has been grown in popularity, Design and Build has evolved all manner of hybrids. However, many contractors are less gleeful about the benefits that might be expected. In theory, Design and Build puts the contractors in charge of the whole project. Nevertheless, in practice clients are demanding more and more say in the design. Then, this will put more risks to contractor. In view of the risk sharing factors, the Design and Build contractors must be able to identify the success factors in order to further ensure meeting of their ultimate mission. This paper intends to theoretically reveal background of Design and Build (D&B). It provides a framework for doctoral research currently undertaking. The paper defines Design and Build. It further discusses D&B's critical success factors which is supported by the findings from other published works is undertaken

2.0 DEFINITIONS AND CONCEPT OF DESIGN AND BUILD

The term "Design and Build" refers to the procurement strategy that entails the contractor carrying out the work; the design works as well as the construction and completion of the work. It is a form of building procurement whereby the contractor will design and construct the project. A Design and Build contract is one in which a single entity, usually a contractor assumes responsibility for the design in whole or in part and for the construction and completion of a construction project. Turner (1990) and Jansen (1991) supported that Design and Build contractor is supplying the procurement option of "buying" a finished building.

While according to Masterman (1992) the term Design and Build has almost been unanimously interpreted and defined as being an arrangement where one contracting organization takes sole responsibility, normally on a lump sum fixed price basis, for the bespoke design and construction of a client's project. This contains three main elements: the responsibility for design and construction, contractor's reimbursement is generally by means of a fixed price lump sum and the project is designed and built specifically to meet the clients' needs. Furthermore, according to David Chappell (1997), Design and Build contracts place responsibility for both design and erection in the hands of the contractor one point of responsibility for everything. In this system contractor will carry out two functions: design and construct.

In other definition, Design and Build is an arrangement where one organization design and construct to the firm order of the client for a single financial transaction. The Chartered Institute of Building (CIOB-1983) defines Design and Build as the process where the client deals 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 process, including engagement of the design team who are, therefore contractually linked with the contractor and not the client.

In general, it can be summarised that Design and Build provides single point responsibility for the whole design and construction. Contractors, who are responsible for the implementation of the project, have power to control all over the projects. This nonetheless does not deter the involvement of the client. The client's need and requirements are always been taken into consideration, which this consequently presents uniqueness of the system.

In practice, Design and Build procurement is generally structured in one of two ways; 1) The clients employ a dedicated Design and Build organization with its own in house design team. 2) The clients engage a general building contractor who employs external design consultant members of the contractor's team for the duration of the project. The organization and management structure for a design-build contract is illustrated in Figure 1.0

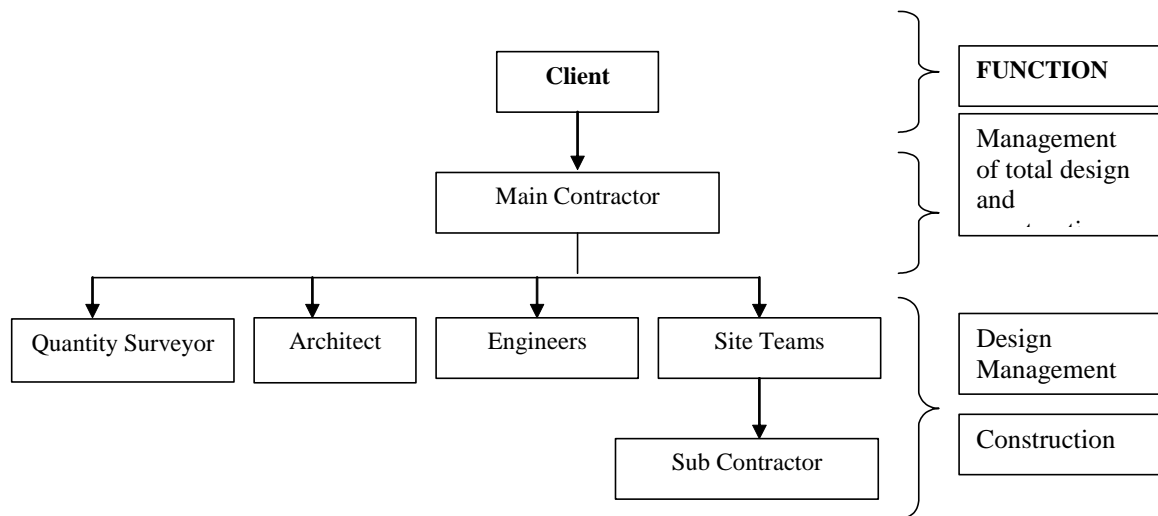


Figure 1.0: Management Structure for Design and Build Contract (Roshana Takim, 1999)

3.0 STRENGTHS OF DESIGN AND BUILD PROCUREMENT SYSTEM

As the Design and Build defined, it is therefore important to reveal the strength or advantages of Design and Build as procurement system. This section, discusses the advantages of Design and Build as a procurement system. The discussion thus provides justification for the selection of Design and Build as a procurement system in construction industry.

The prominent feature of Design and Build is to provide a single point responsibility, which means it should be carried out without any mediating consultants and the central contractual position must be between the client and the contractor. This is achieved by allocating all design responsibility and liability to the contractor alone. The owner may have more design options to choose from the respective design builders who enter the tender. Owner will tend to have variation of design ideas together with the expected cost that was proposed based on his requirements. Unlike traditional approach which only appoint a single unit of design team to come out with the design ideas, Design and Build will produce much more different design ideas from the design builder who enter the tender (P. Chan et al., 1997).

The owner's administrative burdens may be reduced because the procurement of design and construction services is consolidated into a single selection process. After award of the Design and Build contract, the owner will not be required to spend time and effort coordinating and arbitrating between separated design and construction contracts. While the process does require the owner to provide prudent oversight of the design and construction process, this responsibility is considerable less time consuming and exposes the owner to far fewer risks than the traditional approach (P. Chan et al., 1997; Dennis Turner, 1986).

In Design and Build, every negligence or problem will put on contractor's hand. This means nobody is to blame except the contractor, even though it may be supplier or sub contractor causing a problem, but main contractor has to bear the risk. A client retains a responsibility during the contract through his employer's representative.

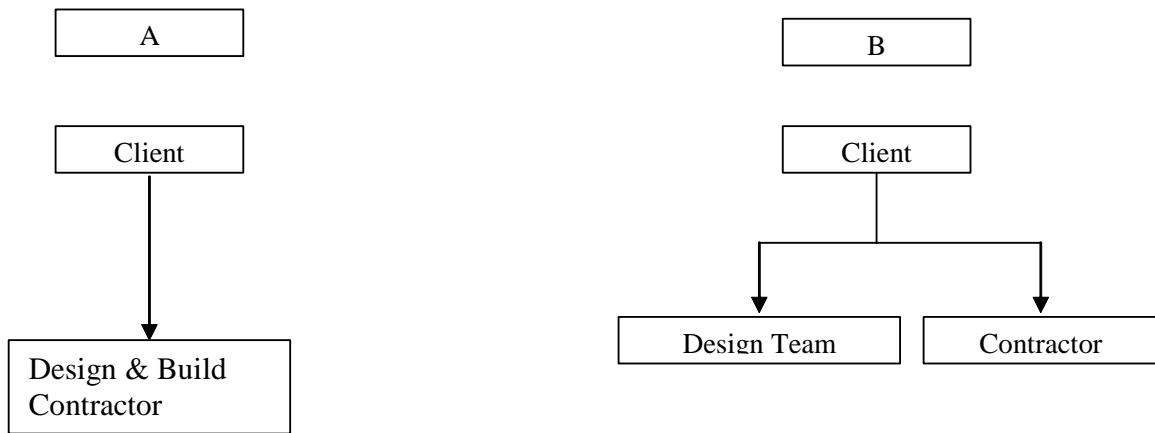


Figure 2.0: (A): Single point responsibility – D & B Contract
(B): Fragmented responsibility – traditional contract
(Source: Bennett and Grice, 1992)

In addition to the single point responsibility, cost and completion time is firmer under the Design and Build procurement method. This means the client knows his total financial commitment in the early stage of the project, provided he does not introduce any changes throughout the project. Because there is no provision for bill of quantities, adequate arrangements for evaluating any changes on the price or on cost basis can be carried out earlier by including in the contract.

The client's interest in using Design and Build is also attributable to several potential benefits derived from the system that may be less easily attained or non-attainable through other systems. The clients who employed Design and Build procurement approach has a single point of contact for all questions regarding the design and delivery of the facility (P. Chan et al., 1997; Keith Potts, 1995; NSPE, 1995; Jeffrey L. Beard et al., 2001; Shawn S.N. Chong, 2002). The Design and Build entity is responsible for quality, budget, schedule, and performance of the completed facility. With the single point of contact, clients can concentrate on definition of needs and timely decision-making rather than on coordination between designer and contractor. Besides, the Design and Build entity has total responsibility for the finished product and cannot shift design errors or construction defects to another party. Therefore, it will likely to end up with the expected or higher quality of end product. Unlike Design and Build approach, traditional approach contracts rely on restrictive wording, adversarial audit and inspection requirements and the legal system to attain project quality (Jeffrey L. Beard et al., 2001).

The next factor associated with the strength of Design and Build is design efficiency. Construction efficiency may be improved because design efficiencies can be woven into the entire construction process. The designer as a member of the Design and Build teams, are participated directly in troubleshooting and resolving design related issues that surface during construction. The early input of the design teams to the contractor will increase the constructability of the entire design (P. Chan et al., 1997; NSPE, 1995; Keith Potts, 1995). In addition, Design and Build is the one project delivery methodology that elicits creative responses from the project teams (NSPE, 1995). Normally, the ability to innovate in design and construction is severely curtailed by the user of prescriptive specifications. With Design and Build, performance requirements are stated and the design builder may use different solutions to meet the client's ultimate project goals. In fact, the selection process often encourages comparison to see which proposal provides the most value to the client.

In terms of certainty in time, Design and Build can provide complete contractual certainty on completion for clients from the very earliest stages of their projects if there are not many changes by then client (Bennett and Grice, 1992) for most clients' time is crucial in forming their perspective of the building process. The NEDO report (1995), faster building

for industry, highlights that in most cases, non-traditional procurement method including Design and Build tend to be quicker both in term of site construction and total project time. Time savings with Design and Build are maximizes at the pre contract stage with the procurement process up to commencement on site. Studies by Fitchie (1996) indicate that procurement time under the traditional process can be up to twice as long as that of Design and Build.

These benefits are accrued simply because of the ability of Design and Build to integrate the project team members, produce open communication and encourage effective co-operation. On the matter of speed, it may be reasonable to expect that the overall project duration is shorter on Design and Build projects or that can it be completed on time due to the overlapping of design and construction phases. Extensive independent research has shown that Design and Build usually achieved early completion of a development, with both the tender and the final cost being significantly lower than conventional schemes. In other words, construction time is reduced because Design and Building proceed in parallel. Therefore, the integration of design and construction should produce more effective programming. Nevertheless, Design and Build is also considered to be the fastest project delivery system because the procurement of design and construction services is consolidated into a single selection process and the fast tract procedures may be implemented more readily (NSPE, 1995; Jeffrey L. Beard et al., 2001). Generally, Design and Build encourage overlapping of design and construction phases. Bidding periods and redesign, two events that can occur with traditional approach are eliminated. Materials, equipment procurement and advance construction work may progress concurrently before construction document are completed.

In supporting the above, Masterman (1992) highlights that many studies have proved that design projects were associated with shorter overall project time than conventional system. It is also reckoned that the reduction of the overall project period is attributed to the system's ability to overlap the design and construction phases, improved communications between the various members of the project team, the integration of the two basic functions of design and construction and the improvement in build ability and the use of contractor's resources. However, the client's consultant should be given time to prepare an adequate set of client / employer's requirements as well as comparing and evaluating the offers and schemes from competing tenders. It should identify that the tenderers can adopt their own preferred methods of construction. This is normally impossible under a traditional method, and it encourages commitment and keen pricing on the part of tenders.

Cost has always become the key considerations affecting adoption of Design and Build procurement method. Whilst project time is relatively easy to interpret and potential savings clearly identified, project cost is more ambiguous and therefore difficult to evaluate. A prominent consideration for the client, in any procurement form, is that final cost does not exceed the project budget. In this respect, Design and Build certainly presents a better chance of the client obtaining his completed building within budget. Jerry Adanison (2001), explained that several financial considerations make Design and Build desirable. Private sector have implement Design and Build for financial reasons. Design and Build in the sense that "Time is money". Completing a project quickly san save owners used to finance projects.

On the question of cost, real cost savings can also be made in Design and Build. According to Mastermann (1992), when using this system, the initial an final costs are lower than when using other methods of procurement because of diminished design costs, the integration of the design and construction elements and in built build ability of the detailed design. Cost savings may also result in timesaving. The overall effects is reduction in the employer's financing charges, lesser effect of inflation and faster building operation, which, in a commercial context, produces an earlier return on the capital, invested, (Frank 1998).

Quality of the project is not simply compromised by using the Design and Build form of procurement. Its reputation has suffered from criticism by some construction professional of projects, which involve system building and standardization. Quality control and quality assurance are the essential elements of project review that what is being paid for is up to the

standard specified. In Design and Build have allows better control of quality particularly in designer lead Design and Build team. However, in considering quality, the client has no direct control over the contractor's performance. Therefore, the standard of quality must be properly selected at the tender stage to ensure that the contractor's proposal do meet his requirements. This also means that the client ha little say in the choice of specialist subcontractors (Clamp & Cox 1989). This is because some proprietary Design and Build products lack aesthetic appeal. Design and Build has a considerable ability to improve quality in construction. When procured in isolation, design has always pre supposed that the client himself has identified his genuine needs, defined his requirements and specified them clearly, the client often ha little clear definition of what he wants.

Effective communication is never been ignored as one the driven factors on selection of Design and Build procurement method. Direct contact between the client and the contractor as provided by a Design and Build system lines of communication and enables the contractor to respond and to adapt more promptly to the client's needs. Integration and interchange is thereby encouraged inherently within the system (Griffith, 1989). The client and contractor will communicate closely during the process stage of the project. Communication between them will start at the beginning stage of the project. Therefore, in Design and Build it provides the client and contractor an opportunity to interact more often and more directly than traditional contract. The system allows understanding on the requirements of clients clearly and any misunderstanding or conflict that may be occurred during the design and construction stage can be avoided. Design and Build approach is also known to have less adversarial relationship compared to traditional approach. The project may proceed more efficiently because designers and constructors are members of the same team and thus much less disputes might be created. Apart from less disputes, Design and Build also benefit from the good communication that can be occur between the design team and the construction team (NSPE, 1995; Keith Potts, 1995).

In terms of suitability, Design and Build is relatively suitable for large and complex project. For projects of exceptional size, the firm must have the managerial expertise to hold a balance between design and construction interest. It also simple and more efficient for sub-contract arrangement integrating design and construction expertise within an accountable organisation. This is because there are no nominated subcontractors or nominated supplier.

Claims for errors or omissions or for time delays tend to disappear because the Design and Build team would have no one to blame for these shortcomings but itself. At the same time, the burden on the owner to mediate disputes between the designer and the constructor is eliminated because a sole design builder may be held contractually accountable and responsible for the entire project (Jeffrey L. Beard et al., 2001). The Design and Build process also allows the contract to assign risks in a way that produces the most efficient agreement among the parties. Risks can be assigned, as appropriate to the owner, to the design builder, shared between the two principal parties or mitigated by the securing of insurance coverage. All risks can be accounted for discussed and dealt with in a manner that is more clear and comprehensive than with other delivery method (Jeffrey L. Beard et al., 2001).

Under Design and Build, all parties are being treated as professionals regardless of designer or constructor. Design and Build places the designer and constructor on equal professional footing so that they can provide unified recommendations and jointly developed solutions to the client (Jeffrey L. Beard et al., 2001). There is an old workplace adage that says that if you treat individuals as professionals, they will respond as professionals.

As the strengths identified above, relatively firm and lower cost are always the critical strength on Design and Build procurement method. The project costs of the Design and Build delivery method can be lowered because of the close working relationship between the designer and the constructor who are on the same Design and Build team. This may lead to the incorporation of more economical design features and the application of cost saving construction methods (NSPE, 1995; Jeffrey L. Beard et al., 2001). Therefore, the contractor can take full advantage of his own judgment and expertise in procuring only those sub

contractor and suppliers with whom he expects to have a successful working relationship and the clients is not involved in this relationship at all (Griffith, 1989.)

4.0 RISKS IN DESIGN AND BUILD

Design and Build contracting is an innovative procurement method whereby a single contractor is responsible for the design, construction and completion of the large projects. In view of this recent widely accepted procurement method, the risks adhered to Design and Build projects must be first identified to ensure accomplishment of Design and Build projects delivery.

Although the Design and Build projects are expected to deliver the project faster and cheaper as compared to the old Bid and Build projects, not all the Design and Build projects can really accomplished it.

According to Bread, et. al. (2001), the single-source approach of Design and Build consists of a firm or team of architect, engineer, and contractor professionals who are at risk for the cost, schedule, quality and management of the project. Therefore, a though study on the risk must be identified, examined and analysed to ensure the success of the project procurement method.

Generally, it is possible for Design and Build contractors to identify the risks elements in a construction project. Risks in particular to construction industry seem to be less concerned and almost non-exist in Malaysia. Jamal Fuad Al-Babar (1988) emphasized that risk is inherent to all construction projects. From start to finish the construction process is complex and characterized by uncertainties. Quite often the construction projects fail to achieve the time, quality and budget goals. This failure is often due to the occurrence of unexpected events that a contractor has failed to identify, analyse and manage properly.

Traditionally, risks treatment in construction has focused on risks distribution between the owner and contractor during the construction phase by adopting suitable contractual clauses. This distribution, is generally 'one sided' and assumes that the contractor should assume responsibility for most of the risks associated with the projects. The contractual clauses, however, used by both owners and contractors to protect themselves against project risks have shown to be generally ineffectiveness. Regardless of how a contract allocates risks, in practice contract clauses do not always enable a contractor to accept contractual risks in addition to the inherent risks in their operations as part of the business venture.

In Malaysia, most contractors have developed a series of 'rules of thumb' that they applied when dealing with risks. These generally rely on the contractor's experience and judgment. Rarely do contractors quantify uncertainty and systematically assess the risks involved in a project. Furthermore, even if they assess these risks, they even less frequently evaluate the consequences associated with these risks. One reason might be the lack of a rational straightforward way to combine all the facets of risks systematically into manageable scheme.

Risks and uncertainties will always accompany projects. The Design and Build contractors must able to make better decisions by a better understanding of risks in Design and Build projects. The Design and Build contractor must absolutely competent to ensure that the risks involved do not at anytime outweigh the benefits to be gained. Due to the deficiency of researches and references in particular of risks inherent to the current widely accepted and popular Design and Build procurement method, it is important to carryout the research on the key success factors and risks involved. Eventually, each new Design and Build projects should be viewed as an opportunity to achieve additional benefits from the identified strengths or key success factors.

Risks are inherent to all construction projects irregardless of its size. However, the Design and Build contract transfer more risks to the contractor than any other construction contract (See figure 3.0). Among a variety of risks, a contractor usually takes on many speculative risks; Risks that can vary in incidence between the parties as they wish.

Although the Design and Build projects are expected to deliver the project faster and cheaper as compared to the traditional bid and build projects, not all the Design and Build projects can really accomplished it. Many empirical studies have been conducted to examine the impact of various project success factors such as the study of factors for a successful public sector Design and Build projects by Songer and Molenaar (1997), study on architects' and builders' views on Design and Build procurement method in Hong Kong by Mo and Ng (1997) and many others (Albert P.C. Chan et al., 2001). Apart from that, National Society of Professional Engineers USA had also listed a list of conditions, which should be taken into consideration by project practicing Design and Build method. Both the studies and listed condition by NSPE shared a common agreement on Design and Build project success factors. Accordingly Chan et al., (2001) has developed a series factors contributing to the success of Design and Build projects. These factors are the duties, responsibilities and capabilities of different project participants including end-users, contractor, architect and design consultants in Design and Build projects.

5.1 Users

Practitioners consider that the end users' input to project is very important in contributing to Design and Build project success. This factor is even more critical for complex Design and Build projects. If the end users' needs are uncertain or ambiguous, it is difficult to develop a comprehensive and clear client's brief for the contractor to propose a suitable design and construct the building. Disputes and claims may be expected if the details of the client's requirements are not adequately stated at the outset. Significant changes made to the client's brief midway through a Design and Build project may lead to poor project performance in terms of time and cost. Therefore, end-users should have a thorough understanding of their own needs and the same applies to other project participants.

5.2 Client

The client plays an important role in contributing to Design and Build project success. To improve the chance of project success, the client should perform the following activities: comprehensive pretender site, develop a clear understanding of project scope, pre-qualify potential tenderers, assess contractors' proposals thoroughly, develop a clear client's brief, establish a capability of managing Design and Build projects, install an effective monitoring and approval mechanisms for design changes, and limit the changes of client's requirement during construction.

5.3 Contractor

Practitioners believe that the contractor should have strong design management expertise and project management capability for Design and Build project. Contractor should also possess a thorough understanding of buildability and develop a good design through the utilization of appropriate construction method.

5.4 Design Consultant

The contractor's design consultants should have a good grasp of buildability for design development. If designers fail to work within budget and on schedule, poor performance would be expected. Design consultants should understand the construction process and develop a cost-effective design on time.

5.5 Teamwork

Mutual trust and respect between client and contractor has been emphasized by practitioners as an important ingredient for Design and Build project success. In addition, to ensure project success, all project participants should share a clear understanding of financial and technical performance required, install adequate communication channel, achieve a high degree of co-operation, sharing of common project goal and develop an ability to resolve conflicts quickly. It is important for all project participants to understand and accept their new roles and duties and the risk and the legal liability they have to face in Design and Build project.

6.0 CONCLUSION

In conclusion, it is essential that who ever really want to procure Design and Build method need a through understanding of the types and characteristics of that kind of procurement. Therefore, benefits of Design and Build can be exploited. Many studies also showed that the characteristic of Design and Build that make Design and Build different from other procurement system in offering single point responsibility, fixed time and money, communication, allocation of risks and others. Getting success in Design and Build projects enables an assurance of getting the project completed at the right time and within allocated budget. The Design and Build procurement system has better time performance and cost benefits, which are essentially what the end-users are concerned about. This research can be a key to assessing the performance level of Design and Build projects, and the project participants can learn about the important factors for setting up an effective management system to turn Design and Build projects with excellent performance.

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