The Influence of Project Characteristics on Contractual Behaviour of Key Participants in Civil Engineering Projects

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ABSTRACT

This paper described the importance of paying attention on the aspects of project characteristics in understanding the contractual behavior of key participants in civil engineering projects. The purpose of this paper was to identify the project characteristics variables contributing to the unfavorable contractual behavior of key participants in civil engineering projects. An extensive literature review was carried out using content analysis and unveiled nine (9) civil engineering project characteristics that may contribute to the contractual behavior of key participants. They were project type, project size, project scope changes, design changes, site surrounding condition, ground condition, project complexity, procurement method, type of standard form of contract. The findings provide basis for understanding the factor that influence the contractual behavior of key participants in order to comprehend the constraints faced by them in implementing the civil engineering projects. Hence, the initiatives or proactive preventing actions can be suggested in future study to improve the contractual behavior of key participants and eventually will lead to the project success.

Keywords: *Civil Engineering; contractual behavior, project characteristics.*

INTRODUCTION

Civil engineering projects are unique. Their natures are very different to that of general building construction where mostly they have to be designed for some specific purposes and specific location before they can be constructed and put into use. This makes, civil engineering projects are the projects that full of uncertainties and most of the time quite complex, difficult to manage and replete with unpredictable behaviour of project key participants. Although, the standard form of contract used for a civil engineering project provides a consensus as to allocating risks and responsibilities of every key participants of the project, unfortunately, literature are still replete with the contractual behaviour of them who fail to adhere with the condition of contract during project implementation (National Audit Department Malaysia 2012, 2015 and Alaghbari et al., 2007). Hence, affect the project performance.

In the context of this study, the term ‘contractual behaviour of key participants’ is referring to an action or a conduct of a key participant towards other key participants of the project based on what are stipulated in the agreed contract. In other words, the contractual behaviour of project key participants can be referred to what extent the contract has been implemented by the people who makes decision by the contract (Abdul Aziz, 2012). One of the common contractual behaviour of key participants that rendered in civil engineering projects is that the delay in interim payment made by the client. The delay

in making interim payment to the contractor will cause big impact to the project implementation and eventually lead to the project failure as have been thoroughly discussed by Sears et al. (2008) and Carmichael (2002). In fact in Malaysian context, the delay in making interim payment was ranked as first in client related cause of project delay (Sambasivan & Soon, 2007). On top of that, the failure of the contractor to comply with the standard construction method (National Audit Department Malaysia, 2016) and failure to comply with the approved work program (Jaffar et al., 2011) are among the factors caused by contractor that contribute to the project failure. Other unfavourable contractual behaviour of participants of project such as direct instruction by the client to the contractor (Rahmat, 2008); late in certifying certifications and project information (Nurul et al., 2016); and communication skill of contractors (Mitkus & Mitkus, 2014) also contribute to the project failure.

THE INFLUENCE OF CIVIL ENGINEERING PROJECT CHARACTERISTICS ON CONTRACTUAL BEHAVIOUR OF KEY PARTICIPANTS

One of the determinants that influence the contractual behaviour of key participants of civil engineering project is project characteristics. For instance, Demirkesen & Ozorhon (2016) observe that large construction project tends to have more uncertainty than smaller projects. Large project size mainly is exposed to uncertain environments such as the uncertainty of the owner's behavior; the uncertainty of the contractor's behavior; uncertainty of the consultants' behavior; and the uncertainty in the transaction environment and mechanism (Guo, 2016). This uncertainty and complexity, combined with the enormous variety of unforeseen situations that can emerge during a construction project, caused disagreements, conflicts, disputes, change orders, and claims can occur in the construction phase (Guo et al., 2016). In fact, based on Transaction Cost Theory, in the situation where the scope of construction project cannot be fully defined due to uncertainty in many aspects of the project, the opportunistic behaviour of the project participants can be unpredictable (De Schepper et al.,2015 amd Chang & Ive, 2011). This theory also stresses on the bounded rationality element. Bounded rationality is where the decision makers make decision under inadequate information (Ling et al., 2013) also will lead to the undesired behaviour of the project participants . These two elements of Transaction Cost Theory are much related to the characteristics of civil engineering projects. Firstly because of the uncertainty in many aspects of its implementation where the scope of the projects is mostly hard to be fully defined clearly where most of the time civil engineering project design might be changed along the way its implementation. Second is because of during the project definition stage, most of the time not all information is complete. This causes the decision makers to make decisions based on available information surrounding them that may be insufficient for whole implementation of the project for instance the chosen type of procurement method, the type of Standard Form of Contract adopted, the project scope as well as the design. Wrong choice of appropriate procurement method as well and Standard Form of Contract specifically for civil engineering projects could be disaster and disrupt the smoothness of project implementation (Ismail et al., 2018). Besides, the stakeholders in civil engineering project are normally large and the variety of stakeholders' participation in a project may influence construction project positively or negatively (Martinez & Olander, 2015). In addition, most standard forms of contract adopted in civil engineering project do not specify the authority and responsibility of every stakeholder. They specify only the authority and responsibility of superintending officer (S.O)/Engineer as the client representative, the client and the contractor. This will become an issue in the event that the behaviour of the variety of stakeholders are not aligned in achieving project goals. Therefore, the two elements explained in Transaction Cost theory are critical and become the basis explaining how the characteristics of civil engineering project influencing the contractual behaviour of participants of civil engineering projects whether intentionally or otherwise. The characteristics of civil engineering projects that may influence contractual behaviour of key participants are described as follows:

Project Type

Civil engineering projects differ different from building projects where building projects provide structure in which people will work or dwell whereas civil engineering projects can be regarded as the discipline or field that provides structure which make the world a more agreeable place in which to live. In other words, the civil engineering project improve transportation, communication and services, thus serve the country's development by underpinning the economic and linking social activities. Due to the broad-spectrum tasks of civil engineering has in improving national infrastructure, there are various types of civil engineering structure with different functions and characteristics available for example highways, tunnels, bridges, dams, airports, ports, pipelines, canals, windmills and offshore platforms. For example, in terms of different characteristics, the characteristics of a road or a railway project would be very different from a dam or a seaport project. This is because the construction of a dam or a seaport is situated in a specific location only. This suggests that all the construction works are carried out in the specified area and does not have to move from one place to another. This is in contrast with the construction of a road or railway project which is of mobile nature as it moves from one location to another location covering a large geographical area. Moreover, the uncertainty and complexity level of different civil engineering project also would be different to one another (Love 2002). These different characteristics of civil engineering projects to some extent will differently have influence on the contractual behaviour of the key participants. Many previous researchers (Cho et al., 2009; Liu et al., 2012; Abdul Aziz, 2012) have concluded that the project type is one of the project characteristics that have influence on the project performance. Unfortunately, all of their studies were on the building projects, none of them focused on civil engineering projects. In fact, the findings of the impacts of civil engineering project would be different due to many types of very different civil engineering projects as opposed to building project. In addition, most of the previous studies related the influence of project type on performance and none of them related the project type on the contractual behaviour of the key participants. Therefore, this study filled this gap in literature by researching on the effects of project type on the contractual behaviour of key participants of civil engineering projects.

Project Size

According to Ali (2008), the size of project is measured based on the ration of contract value. Likewise, Cantarelli et al. (2012) stated that the project size is determined based on the contract value and normally classified into small size, medium size, large size and very large size of construction projects. On the other hand, Demirkesen & Ozorhon (2016) further detailed out that the size of a project can be determined according to the project team size, the project duration and also the size of the total cost in general. This can be summarized that the scale of a construction project can be determined by the aforementioned criteria. Project size is critical since it has potential impacts on the project success (Demirkesen & Ozorhon, 2016). This is because the bigger the size of a civil engineering project, more information and input as well as commitment are needed for its project implementation. Thus, the involvement of many parties and sectors are required. Based on the rule of thumb, there will be a higher of uncertainty in large projects compared to small civil engineering projects. In addition, Lu et al. (2016) and Bosch-Rekveldt et al. (2011) stated that the uncertainty caused by the growth in project size and complexity of construction projects lead to uncertainties in contractual behaviour of key participants where conflict between them becomes unavoidable. Nevertheless, in the study of Dutch transport infrastructure projects by Verweij et al. (2015), there was a significant result showed that, the cost performance of smaller projects were severely poor compared to larger projects. This shows that project size has not significantly influence cost overruns. Odeck (2004) suggested that this is because the greater amount of attention is given by all participants to larger project. It was indirectly shown that the contractual behaviour of the participants in larger sized project were much better because mostly larger projects have better management, proper contract and procedures to govern all the participants implementing their tasks and roles in the project. These contradict results from previous studies therefore impetus to study on whether the size of civil engineering project affects the contractual behaviour of the key participants.

Initial Project Scope and Design Changes

Changes are inevitable and mostly due to the high level of uncertainty conditions in which construction projects operates (Laufer and Tucker cited in Rahmat & Ali, 2010) and the inability of designers to provide for all possible eventualities (Wambeke et al., 2011). According to Verweij et al. (2015) project design and scope changes could indirectly lead to changes of original project contract. In their study, the original project scope changes were the dominant reason that caused contract changes which in turn lead to project cost overruns. Similarly, Russell et al. (2012) also argued that change of design or scope of project is one of the most significant causes of variations in construction projects and resulted in many problems and conflict in later phases of project. In the meantime, the factors such as ineffective design, insufficient planning at the project planning stage and lack of involvement of the client in the design phase highly mentioned by a number scholars as the significant factors causing the changes (Rauzana, 2016, Abdul-Rahman et al., 2015 and Lopez & Love, 2012). Thus, the issues of changes in design and scope must be properly dealt by client and consultant as well as contractor to smoothen the project implementation as well as to avoid conflict among project participants. For instance, conflict may arise when the changes of work issued by the client or consultant but then disagrees with the price and time extension request (Cheung et al., 2008 and Cheung & Yiu, 2006). The disagreement may lead to dissatisfaction and demotivation of carrying works by the contractor where eventually affects the project performance.

Site Surrounding and Ground Uncertainties

Civil engineering projects are unique. Their natures are very different to that of general building construction where mostly they have to be designed for some specific purposes and specific location before they can be constructed and put into use. This makes civil engineering projects full of uncertainty and most of the time quite complex, difficult to manage and filled with unpredictable behaviour of project key participants. In construction industry, Guo et al. (2016) grouped the factors of uncertainty into human factors, environmental factors, and project factors. In general construction projects, the authors further explained that the human factors of uncertainty include the uncertainty of the owner's behaviour and the uncertainty of the contractor's behavior, Nevertheless, the human factors of uncertainty would be higher in civil engineering projects as this type of projects have many other key participants in the project implementation, other than client and contractor.

On the other hand, environmental uncertainty in civil engineering projects are generally high since they cover a large geographical area and variety type of ground conditions in construction. Moreover, for the civil engineering projects such as roads, railways, bridges, tunnels, pipelines, canals and irrigations, the degree of environmental uncertainty would be higher than other types of civil engineering projects. This is because the construction of this types of projects are mobile in nature where the construction of the structures has to move from one place to another place until the completion of construction. According to Guo et al. (2016), if environmental uncertainty is high, initial drawings and specifications are likely to change, and the project members will have to solve many problems during construction where resulting in undesirable contractual behaviour of key participants.

Many scholars associate site access problems with performance of a construction projects (Othman et al. 2006, Cheung & Yiu 2006, Cheung et al. 2008, Xioa-Hua 2009, Mitkus & Mitkus 2014b, Amiril et al. 2014). It is interesting to note that, among all of the aforementioned studies, majority of them thoroughly discussed the effects of site access problems on the conflict and disputes among the participants of the projects. For example, site access denied by client to main contractor and site access denied by main contractor to subcontractors were stated by Cheung et al. (2008) as among the factors causing disputes among project participants. Meanwhile, Othman et al. (2006) related site access issues such as difficulty to get access to site due to squatter problems, land allocated for the project not readily available due to illegal usage by other parties and local residents not allowing contractors to use existing

roads. On top of that, Verweij et al. (2015) opined that the geographical location of the project whether located in the city centre or in remote forestry area could affect project cost performance as well as the relationship among the project participants. This is very close to the nature of civil engineering project, which is dominantly associated with uncertainties in its implementation. Thus, from the literature review, it is found that the ground as well as surrounding uncertainties in civil engineering projects could pose major and costly coordination problems influencing the contractual behaviour of key participants.

Procurement Method

Procurement can be defined as the process of acquiring a building or infrastructure project to fulfil some identified needs and requirements of clients, involving the employment or engagement and coordination of the services of consultants, contractors and suppliers (Wan Ismail, 2007). There are many types of procurement methods available in procuring construction project such as traditional, design and build, management contracting, partnering and others. In procuring civil engineering projects in Malaysia, the traditional and design and build are the mostly adopted types of procurement method (Ismail et al. 2012 and Rashid 2002), especially for civil engineering projects initiated by the government. However, due responding to global acceptance of other types of novel procurement methods, management contracting, Public Private Partnering (PPP) and its variances such as Build-Operate-Transfer (BOT), Build-Operate-Own-Transfer (BOOT) and Private Finance Initiative (PFI) are being adopted in many civil engineering projects in Malaysia (Ismail et al., 2012).

The adoption of the novel procurement methods is expected to increase the collaboration and trust between the participants thus reducing the adversarial relationship among them. According to Adnan et al. (2012), partnering not only increases collaboration between client and contractor but involves the entire construction industry's value chain and players. In addition, problems rendered in civil engineering projects can be solved through responsibilities supportive, learning culture and cooperation promoted in the adoption of these procurement method (Chan et al., 2010). Therefore, it shows that the adoption of the novel procurement method can improve the contractual behaviour of key participants in civil engineering projects.

Unfortunately, despite promoting good relationship and contractual behaviour of key participants in civil engineering projects, the adoption of novel procurement methods turned out to be disaster where many studies revealed that many novel procurement methods attributes are look good on papers but not in their implementation. For instance, in the study of 172 infrastructure project in Belgium carried out by De Schepper et al. (2015), the authors found that many participants were dissatisfied with PPP procurement method outcomes where the PPP transaction are burdened by a greater uncertainty and less mature market compared with the traditional procurement method transaction. The PPP transactions were probably lower in the general building project where the uncertainty and complexity are lesser than civil engineering projects. Therefore, in the Malaysian context, it would be interesting to explore the extent of the types of procurement methods that influence the contractual behaviour of key participants of civil engineering projects.

Type of Standard Form of Contract

There are many types of standard forms of contract available to be adopted in the construction industry. In fact, in Malaysia there are various types of standard forms of contract and can be categorised into three category; i.e, Government or public contract, private contract and contract of an international nature (Rajoo, 2014). The standard form of contract commonly adopted for government projects are PDW 203, PWD 203A, PWD DB/T and CIDB 2000. Meanwhile the standard form of contract used for private projects are PAM and IEM for Civil Engineering Works. In the meantime, the FIDIC Red Book and FIDIC Yellow Book are commonly used for the projects involving international participation in

Malaysia. Since there are many types of standard forms of contract available to be chosen from, the choice of an appropriate and ideal standard form of contract is critical because it will influence the success of construction project implementation. This is because an effective standard form of contract would lend itself to regulate the day-to-day relationship on a construction site and provide a clear and definitive understanding to the parties, professionals and site personnel of their roles, responsibilities, obligations as well as the scope of the project (Rajoo, 2014). Thus, it becomes a very important tool in governing all aspects of construction project implementation. Different types of standard forms of contract, consists of different contract conditions which influences the contractual behaviour of key participants differently. For example, in civil engineering projects initiated by the government, there are three types of standard forms of contract can be chosen for adoption. They are PWD 203, PDW 203A and PWD DB. PWD 203 and PWD203A Standard Form of Contract are drafted based on Traditional procurement system has more adversarial relationship among the key participants compared with PWD DB Standard Form of Contract which is drafted based on Design and Build procurement system. PWD DB enabling more contribution of the contractor at the early stage of construction project encourage more cooperative behaviour among the key participants (Whittington & Dowal, 2006).

Project Complexity

Constructing and managing civil engineering projects are very challenging due to their complexity. The civil engineering projects especially for the project initiated by the government, the complexity in terms of decision making, procedures and bureaucracy as well as design and technical complexity are prevalent (Marique, 2013). In fact, many previous studies have focused on this matter and provided suggestions to manage the complexity issues effectively (Marique 2013; Martinez & Olander 2015; Bosch-Rekveldt et al. 2011; Charoenngam & Yeh 1999; Tadelis & Bajari 1999). For instance, in managing a complex public initiated project, Marique (2013) argued that, the adoption of PPPs/PFIs procurement method is capable in resolving the construction complexity problems by encouraging trust among the project participants and transparent decision making process. Likewise, Akintoye (1994) proposed that the design and build procurement method has the potential in managing construction complexity because the adversarial relationship can be reduced in this types of procurement method. Thus, encourages the cooperative behaviour among the project participants. On the contractual arrangement aspect, Tadelis & Bajari (1999) suggested that cost plus contracts are more preferable to fixed price contracts when a project is more complex. This strategy is important to cater any possibilities rendered by the construction complexity. These inconsistent suggestions from different researchers shows that the complexity problems are prevalent in construction industry where the degree of complexity is different based on types, size, number of stakeholders as well as the environment surrounding the construction site (Bosch-Rekveldt et al., 2011). Comparing with other types of construction projects, civil engineering projects are the example of the construction project characterised with high degree of complexity.

Although many studies have focused on the complexity of construction project where many suggestions have been made in overcoming the rendered problems, unfortunately, very limited studies have done to relate the construction project complexity with the contractual behaviour of the project participants. The contractual behaviour problems caused by the construction complexity should be given the same attention by the scholars as well as the construction practitioners because they can reduce project success. This is in accordance with the study by Jaffar et al. (2011) which stated that a complex project with a lengthy processes and procedures in design and construction as well as the involvements of variety stakeholders has higher possibility of conflict among the project participants. The complexity of construction project leads to mistrust among the participants especially for the complex project which adopts traditional procurement system. On the other hand, the standard forms of contract commonly used for less complex construction project, are not appropriate to be adopted in a complex project mainly because of the standard forms of contract becoming incomplete to cater the need of a complex project (Chan et al. 2006 and Harban Singh 2004). Therefore, this would be interesting to explore the

extent of the complexity characterised by civil engineering project influencing the contractual behaviour of the project key participants.

Adequacy of Design Details and Specifications

The nature of civil engineering project which is complex and full of uncertainties makes many civil engineering projects start the works on site with incomplete and inaccurate design. As a result, changes are inevitable due to the high level of uncertainty conditions in which construction projects operate (Laufer and Tucker cited in Rahmat & Ali, 2010) and the inability of designers to provide for all possible eventualities. The design changes especially during construction stage could be very costly and prolong the project duration. Beside the complexity and high level of uncertainty of civil engineering projects, the urgency to start the project also might lead to many civil engineering projects starting on site with incomplete and inaccurate design. Since civil engineering projects such as roads, bridges, tunnels and earth support structures provide facilities for public, the project implementation should start early before the comprehensive design can be fully developed to suit locality condition and demand. This incomplete and inadequacy of specifications causes difficulty for the contractor to define the exact scope of work in advance. The consequences may create difficulties determining the actual time and cost of the works as well for planning the overall activities on site, leading to project failure. On top of that, the inadequacy of design information is also determined as a source of conflict among the project participants (Okoroh cited in Ali et al. 2014). Thus, the adequacy of design information and specification influence the contractual behaviour of key participants in project implementation should be investigated.

CONCLUSION

From the aforementioned discussion, it is found that the project characteristics may have influence on the contractual behaviour of the project key participants directly or indirectly. Overall, nine (9) project characteristic variables that might influence contractual behaviour of key participants in civil engineering projects were identified i.e project type, project size, project scope changes, design changes, site surrounding condition, ground condition, project complexity, procurement method, type of Standard Form of Contract. This research embarked on the assumption that a successful civil engineering project would be possible if all key project participants duly comply with the conditions of contract in implementing the project. Hence, these factors are important to be put more concern and empirically tested to determine their level of influence on contractual behaviour of key participants. As a result, the initiatives or proactive preventing actions can be suggested to improve the contractual behaviour of the civil engineering project key participants and eventually will lead to the project success.

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