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Coordination Factors and Construction Project Performance: An Investigation Of Design And Build Projects In Malaysia

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Abstract:
The importance of the construction industry in any economy cannot be neglected. Although the industry is flourishing around the globe but there are still some hinders affecting the performance of this industry. During the last few decades, the construction industry faced a rapid increase in large-scale construction projects with complex and complicated activities. the increased level of complexity in the construction industry impeded many problems that can affect performance. Therefore, the importance of coordination activities has got importance in today's construction projects. The complexity and simultaneous project activities make coordination and communication a key aspect of construction projects. This study is an effort to identify and investigate coordination factors that affect project performance. For this purpose, a crossectional data was collected from 301 respondents in the Malaysian construction project industry by purpose-built questionnaire. The collected data were analyzed by SEM using smart PLS to estimate the impact of critical coordination factors n the performance of DB project Malaysia. Our results explain that all the identifies coordination factors have a significant impact on project performance. This study is significant by providing and investigating an innovative phenomenon that has been ignored in the previous literature.

Keywords: *DB Projects, Coordination Factors, Project Performance, Malaysia.*

I. INTRODUCTION

The economic performance of a country can be influenced dramatically by the construction industry. The construction industry contributes to the economy and the gross domestic product of any country. Construction as an essential industry contributes from 6-10% of the Gross Domestic Product (GDP) of developed countries, and 3-6% to the GDP of developing countries (Razak Bin Ibrahim et al. 2010). During the last few decades, the construction industry faced a rapid increase in large-scale construction projects with complex and complicated activities. The nature and fragmentation of construction projects led to a significant influence on project cost, time, and quality performance. Hence, the increased level of complexity in the construction industry impeded many problems that can affect performance.

The construction projects got more complex recently due to the complication of designs and increased user's expectations. The complexity of construction projects requires a proper coordination process to ensure smooth transmission of information among the project participants. The building complexity can cause coordination problems in construction projects (Austin, Baldwin, Hammond, &Waskett, 2009). In the construction industry, there are different types of delivery methods such as the traditional delivery method – design bid built (DBB) and design and built (DB) delivery method. In the traditional delivery method, the works are divided into two stages, the design stage and the construction stage. After completing a full package of designs, the bid process starts and the contractor is selected based on the technical and financial offers submitted and the owner requirement. In this type of delivery method, the contractor is not responsible for the designs and the owner has a contract with the contractor and he/she can appoint a consultant to supervise the construction activities. However, DBB projects suffered from many problems such as time overruns, extra costs, and conflicts between the owner, contractor, and consultant. DB project came to existence to solve some problems in traditional projects. In this type of project delivery method, the owner appoints a single entity (either the designer or the contractor) who is responsible for the designs and construction activities. Unlike the traditional method, the contractor can commence in construction activities on-site, as soon as the designer finishes the preliminary designs. However, DB projects may also have problems and the adequacy of the current DB projects is in question (Isa et al. 2011). Coordination problems may arise in DB projects due to complexity and complicated information. This is due to a large number of actors in the design and onsite construction (Gray & Hughes, 2001).

Few studies have been conducted on the DB problems and most of these studies ignore coordination issues (Chang, Shen, and Ibbs 2010a). Design construction concurrence and other problems may be varied such as lack of collaboration and poor coordination between the designer and builder, lack of completed information and designs and lack of related experience (Terwiesch, Loch, and Meyer 2002; Cheng and Tsai 2008).The DB projects lose their advantages over other project delivery methods if the coordination procedure is inefficient. If there is no proper coordination and collaboration mechanism, the DB projects will lose their designated effect and advantages over DBB projects (Chang, Shen, and Ibbs 2010b). Therefore, in DB projects, the outcome of poor coordination can be of poor quality. Hence, coordination is an important factor that may affect the DB project performance (Urup, 2016). Solving coordination problems provides a solid foundation for better performance of the DB project (Chang et al., 2010a).

Previously some researchers identify the coordination factors affecting construction projects. (Alaloul, Liew, Amila, & Zawawi, 2016). However, further studies need to be conducted to investigate the impact of coordination factors on the performance of projects. There is no comprehensive study that focuses on identifying coordination factors affecting DB project performance. Moreover, This study is conducted in the special circumstances of Malaysia where different socio-economic conditions impact the framework. Keeping in view, the importance and urgency of coordination problems in construction projects particularly DB projects. This study believes that the framework of

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this study is critical to enhancing the performance of DB projects.

The study is significant by providing theoretical implications and construct a unique coordination framework for DB projects. The framework of coordination factors will help to provide a general understanding of the coordination framework of DB projects. Further, the applicability of the coordination framework in DB projects of Malaysia will provide specific information regarding each factor and its specific importance and urgency or application in Malaysian DB projects. In addition to theoretical contributions, our study provides empirical evidence by correlating the identified coordination factors with DB project performance. This highlights the importance of coordination factors for DB project performance in general and Malaysian DB project performance in particular.

II.LITERATURE REVIEW

The construction sector in any country plays a major role in improving the economy. It positively affects the development of the overall economy. For instance, Malaysia has witnessed a rapid growth of the construction industry in the last few decades. Although, this sector still faces serious problems and critical issues of poor performance related to time, cost, poor productivity and construction waste (Memon, Abdul Rahman, and Abdul Azis 2012).

A study was undertaken by Endut, Akintoye, & Kelly (2005) on cost and time overruns in the Malaysian construction industry. it is reported that only 46.8% of the public sector and 37.2% of private-sector projects were found completed within the stipulated budget in Malaysia while only 20.5% of the public projects and 33.35% of the private sector projects were completed within the time (Endut, Akintoye, and Kelly 2005). In the last decade, Malaysia has seen a numerous amount of construction projects. However, over a period of time as projects get more complex, it requires more management skills. The traditional procurement method was found ineffective according to modern needs (Seng and Yusof 2006). The introduction of the DB projects procurement method is an alternative to conventional projects which became popular in Malaysia, especially in the public sector (Seng and Yusof 2006). In DB contracts, work must be conducted through a productive collaborative process amongst project participants. DB method brings some advantages to the projects due to the singular responsibility of designs and construction. The contractor is usually responsible for the design and construction activities such as cost, time, and quality improvement (BFC 1995; DBIA 1997). Despite the advantages of DB projects, this type of contract stills suffers from serious coordination problems which may affect their performance.

DB projects require a considerable amount of planning, communication, and related experience (Williams 1995). Nevertheless, DB projects need a proper coordination process and enough related experience to have a successful performance (DBIA 1997). Therefore, it is necessary to identify the coordination framework in such types of contracts to identify its effectiveness. According to Cheng & Tsai, (2008)and Terwiesch et al. (2002), problems in DB projects may exist due to the design and construction (DC) concurrence. In the DB method, it is essential for stakeholders to coordinate through collaborative interaction due to the sensitivity of project quality with coordination (Urup 2016). For instance, new drawings to be received on-site which requires proper and careful coordination with the construction team. The coordination problems between designers and an existing construction team may fail to reflect existing situations and resulting in a huge amount of unnecessary costs paid by the owner. Consequently, this may lead to losing the advantages and effectiveness of DB projects (Urup 2016). Problems of DB project such as lack of collaboration and coordination between builder and designer, lack of complete information on designs, and lack of related experience may lead to an increase in the cost and time of the project and sometimes leads to failure of the project(Tzortzopoulos 2007).This study identifies major coordination factors that can affect the performance of DB projects. A brief review of the literature on each coordination factor is discussed in the subsequent section.

Coordination factors in Construction Projects

Coordination is the guaranty for getting the right information and material to the right actor at the right time to improve productivity (Alaloul et al., 2016). It is difficult to come up with a theory for the coordination process, coordination theory can be obtained based on the understanding of how project participants work together (Alaloul et al., 2016). Some literature has come up with a definition of coordination as managing tasks, activities, and uncertainty (Flyvbjerg 2011). Some researchers define coordination as time restrictions and uncertainty management (Melin and Axelsson 2005; Jones and Lichtenstein 2009).

Chang et al. (2010a) stated that coordination problems arise due to improper planning and execution. Improper planning includes a high level of concept designs and execution includes inconsistent DC amount, delay in the review process, and poor feedback between contractor and designer. Lack of DC coordination may cause time and cost increase and conflicts. Generally, it is difficult for the design firm to fit together with the construction process due to the little feedback from the construction team. In complex projects, the complicated and large number of information may lead to many coordination problems between project participants (Gray and Hughes 2001). Therefore, DB projects need proper coordination process amongst actors of the project. The coordination process between DB project participants is suggested through collaboration and interaction ; (Urup 2016). Poor coordination and communication among project stakeholders were identified as common design waste causes across all project stages (Osmani 2013). According to a study conducted by (Chang, Shen, and Ibbs 2010b) titled Design and construction coordination problems and planning for DB project new users. Below is a comprehensive literature review on the critical coordination factors in construction projects.

Scheduling and Planning

Communication and coordination plans are essential to come up with a framework of a coordination procedure for every participant in the project to avoid disputes, conflicts, and misunderstanding. A well-coordinated plan is important because actors will share important information if they start to cooperate and trust each other (Seng and Yusof 2006). It helps to get the needed information in a proper manner for immediate decision making that influences the BD project performance. Therefore, proper coordination is vital while making plans. Similarly, Abbas, Din, & Farooqui (2016) argued that proper coordination among all parties in the pre-planning stage is necessary to make the feasible project and also integral for the success of the project.

A study conducted by Liberatore and Luo (2010) on Coordination in Consultant-Assisted Projects using Agency Theory Perspective. They noted that coordination is more complex for consultant-assisted projects and is critical for project success. A research model was developed to examine how coordination can help in building relationships and a harmonious atmosphere that affects project performance in a positive direction. Liberatore & Luo (2010) claims that inter-organizational coordination has the largest overall significant effect on project performance. Building trust and goal congruence reduce uncertainty hence, the high performance achieved. Project uncertainty, including both technical and requirements uncertainty which can be reduced by coordinating with all the parties at the planning stage.

In the DB procurement process, scheduling is different from conventional projects. The design and construction activities mostly overlap. The contractor may start the earthworks even before the completion of the preliminary designs. After the completion of the preliminary designs, the contractor may start the foundation works. While the contractor is working on the foundation, the designer may be working on final designs at the same time. Though projects may vary and overlapping also may be

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different depending on the project. Therefore, coordination in the scheduling process of the DB project becomes more significant. Similarly, some cases have been reported due to improper coordination between contractors, designers, and subcontractors while scheduling delayed the projects. Alaloul et al. (2016) added that coordination also important in scheduling and found it as a major reason for delays in residential projects in Malaysia. Another study conducted on the performance of construction projects revealed that improper scheduling by the main contractor played a significant role in affecting project performance (Amoah, Ahadzie&Dansoh, 2011). Zidane & Andersen (2018) found the top universal delay factors in construction projects where poor coordination in planning and scheduling and poor coordination and communication between parties of the project were top of the list.

Construction projects still suffer from coordination issues. " despite its growth and contribution to the GDP, this fragmented sector has poor coordination among its project participants, leading to horrific material control with time and cost overrun" (Razak, Othman, and Sundram 2015). According to Hameed Memon et al. (2014), poor communication between parties at scheduling by contractors is the most serious factor affecting construction cost. Memon, Rahman, Abdullah, & Azis (2014) argued that poor planning and scheduling by the main contractor is an effective factor to impact the project cost performance. Some researchers indicated that the most significant factor that has the maximum positive influence on the performance of construction projects is the coordination among project parties (Zavadskas et al. 2014).

Recognize that communication is essential, design progress meetings, and construction progress meetings between designers and contractors should be scheduled regularly. Frequent project meetings with the PM, the contractor, designer, subcontractors, and other interested parties are necessary (Handbook, Specific, and Management 2016). In addition to this, it is reported that frequent coordination and progress meetings among designers and contractors are essential to control the time and cost of construction projects in the southern and central regions of peninsular Malaysia (Ismail, Aftab, & Asmi, 2012).

The continuous progress meetings are also significant to continue the feedback loop. The advantages of DB projects cannot be fully exploited if the information feedback loop is not working well between the designer and constructor (Chang, Shen, and Ibbs 2010b). Incomplete or un-optimized design information increases cost (Terwiesch, Loch, and Meyer 2002). In complicated projects, the information flow is necessary for the timely completion of the project (Austin, Baldwin, Hammond, &Waskett, 2009; Gray & Hughes, 2001). Hai et al. (2012) argued that the result of proper coordination is a high quality of obtained information with less duplication that can prevent time delays and cost inefficiency in construction projects. Gelernter and Carriero (1992) defined coordination as the role of information exchange throughout the project life cycle and showed that coordination plays crucial roles in information sharing in pursuing the participants in unified direction to prevent conflicts of information.

Moreover, Xue (2006) claimed that the relationship between different groups of an organization can be improved through the proper coordination process. Consequently, coordination is a necessity in ensuring the improved relationships of project members, tasks, and activities in terms of cooperation, integration, and collaborative working environments. Poor coordination processes between all stakeholders resulted in an increased amount of inconsistencies and delays in the construction process. Although, coordination between participants always faces challenges in construction projects and the mastering of cooperative processes is very important for project success (Kubicki et al. 2006).

Chang et al. (2010) argued that proper coordination in planning makes it possible to clearly

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identified the task and required time for each task. Hence, it is important to produce the overall CPM schedule including all the tasks of the project to introduce the work break-down structure (WBS). Further, coordination of team members is important to prioritize tasks. Scheduling and planning is an important factor in the success of the project. Hence, proper coordination while scheduling and planning project activities is vital. Hence, it is hypothesized that:

H1: Scheduling and planning coordination is a significant factor for DB project performance

Human Resource Coordination

Construction projects still suffer from coordination issues. " despite its growth and contribution to the GDP, this fragmented sector has poor coordination among its project participants, leading to horrific material control with time and cost overrun" (Razak, Othman, and Sundram 2015). Consequently, construction projects require proper coordination. Razak et al. (2015) noted that coordination especially needed for the procurement process and internal resources such as human resource factors. The purpose of Razak et al. (2015) study is to establish a conceptual framework on the relationship between performance and internal resources mediated by coordination. The framework established by Razak et al. (2015) used the resource-based theory to explain the relationship between variables. It is recommended that further studies be conducted to examine the proposed conceptual framework as the construction projects are different. The different structures of the DB procurement system and employees lacking enough experience in those types of projects create coordination issues. Chang et al. (2010a) found that lack of previous experience in proper coordination of human resources affects project performance. Furthermore, the main contractor and the PM must have enough knowledge and proper related experience in these types of contracts as stressed by Taylor et al. (2010). Failure in this may arise problems and the BD project may lose its advantages. Similarly, Ng & Price (2008) contended that inexperienced staff fails to coordinate the technical administration work. However, coordination issues due to the inability of staff members may also arise when there is the unavailability of personals with high experience and qualification (Enshassi, Mohamed, &Abushaban, 2010). Sambasivan& Soon (2007) found the causes and effects of delays in the Malaysian construction industry and found that Inadequate contractor experience also an important aspect for poor coordination. Additionally, Babalola Ifedolapo Helen, Oluwatuyi Opeyemi Emmanuel, Akinloye Lawal (2015) alludes that lack of proper training of team leaders leads to poor communication and coordination with team members and ultimately affect the performance of construction projects. It also found that adequate experience of project consultants also a significant element to coordinate on complex projects (Alaghbari et al. 2007). Oyedele et al. (2915) highlighted empirical research in Nigeria that showed that the low level of skill and labor experience are the most vital factors leads to poor communication.

Coordination can be through controlling dependencies between activities and by determination of dependencies' type, then establishing the coordination process appropriately."Processes analyzed include those for managing shared resources, producer/consumer relationships, simultaneity constraints, and task/subtask dependencies" (Malone and Crowston 1994). Three different ways of applying coordination views: by understanding the outcome of information technology and its effect to human organization, by implementing cooperative work tool and by implementing parallel computer systems. There is still no widely accepted name for this area, so we will use the term coordination theory to refer to theories about how coordination can occur in diverse kinds of systems (Malone and Crowston 1994).

Williams, (1995) ponder the stress on the high turn over of project staff leads to the breakdown of proper coordination which is an essential element of the DB project. Tam et al. (2000) found that labor turnover is an important factor for coordination gaps

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that impacted public housing construction in Hong Kong. Gelernter and Carriero (1992) defined coordination as the role of information exchange between active participants. It shows that coordination plays crucial roles in information sharing in pursuing the participants are in one direction to prevent conflicts of information. Formal and informal team collaboration provides incubation for developing communication systems and channels and may also have different influences and effects on performance. It is important to identify the critical factors affecting team communication in order to achieve a proper effective communication in construction projects, which consequently could influence communication performance based on the understanding of the complex communication between parties of the project (Pocock et al. 1996).

The framework established by Razak, Othman, & Sundram (2015) using resource-based theory for the purpose of explaining the relationship between human factors and project performance. It is noted that coordination especially needed for the procurement process and internal resources such as human success factors. The relationship between performance and internal resources mediated by the coordination of the procurement personnel. It is also acknowledged that coordination among personnel benefits the proper resource allocation which is strategically significant (Irizarry et al., 2013). It is evidently shown that concerning the coordination issues among staff members can produce progressive individual as well as organization-level performance results (Crook, Todd, Combs, Woehr&Ketchen, 2011). In contrast to some authors found a significant positive association between human capital and project performance (Mahsud, Yukl and Prussia, 2011), Mahsud et al. (2011) contended that relationship of human resource and performance of the project is mediated by internal factors antecedent the performance. Therefore, this study argued that the effectiveness of human resources affected by improper communication and the project performance suffered. Therefore, the management of human resources to maintain project efficiency is of the utmost importance. Hence, it is stated that:

H2: Human resource coordination is a critical factor for project performance.

Documentation and Records Coordination

The documentation process throughout the project is essential to record the fast-paced nature of DB projects. Poor/incomplete documentation, for instance, designs documents and engineering documents caused a delay or improper design as investigated by Zidane & Andersen (2018b). Hence missing information or errors in documentation can cause trouble in construction which may lead to errors and mistakes in the engineering part. This ultimately affects the performance of the construction project and also the quality of the project suffers. Similalry, Ajayi & Oyedele (2018) asserted that waste efficiency is a significant aspect to minimize the cost of the project and complete the project within the stipulated budget. The accurate amount of material is ordered based on the design documents, therefore, if design documents are not accurate and the bill of quantity is inappropriate may cause higher cost. Therefore, for accurate design documents, proper coordination is of utmost importance. Documentation issues are significant for construction projects to control the completion timeline and budgetary constraints.

Moreover, proper documentation and detailed record-keeping along with documentation control are essential for the systematic progress of the construction project. The documentation control largely depends on the skills of the project manager. The project manager should have legal and communication skills to properly control the flow of documentation and communicate the relevant stakeholders to collect and transmit information during the whole life of the project (Atout, 2008). In addition to this Rowlinson (1988) stated that proper documentation in the DB project reduces the time and cost over-run. It is further argued that proper documentation flow and control is difficult without essential communication with the involved stakeholders.

Record maintenance i.e. drawings, information, directives, and verbal instructions are significant for project design and construction performance. Hence, coordination from each party to provide proper execution documentation plan of responsibilities to all actors involved in the project is of utmost importance in the eyes of Alaloul, Liew, & Zawawi (2016b). The importance of document and records cannot be neglected in construction projects. To record the proper documents an efficient communication channel plays a significant role to provide accurate and timely information about project activities. Therefore, this study hypothesizes that:

H3: Documentation and record coordination is significantly important that influences DB project performance.

Contract Implementation Coordination

The execution of the contract necessitates that the agreement ought to be commonly justifiable. Therefore, coordination in developing the contract and successfully implementation of the contract is essential. the contractor is obligated to prepare designs and finish the construction works commonly with lump sum fees. This means that the design professional is either employed by the contractor or is working with the contractor in a joint venture style arrangement (Shapiro, 1994).

A contact individual ought to be named to arrange with all the pertinent gatherings. Coordination can play a critical role in building and maintaining good relationships between client and consultants and improving project performance" (Liberatore and Luo 2010). Further, continuous correspondence is important to make the vital alterations in the contract and to acquire determinations and specialized subtleties (Wong and Vimonsatit, 2012). Furthermore, clashes settling among development parties dependent on contract as right on time as could reasonably be expected, before compound, as venture suspension need formal and casual coordination among invested individuals (Sambasivan and Soon, 2007).

Chris (2009) as cited in (Hai et al. 2012) stated that every construction project is unique in nature as it includes a countless number of interrelated activities, tasks, and work packages. Xue (2006); Kubicki et al(2007); Adedeji (2008); Hassoin (2009) and (Hai et al. 2012) claimed that in order to thoroughly rectify the traditional business procedure, construction projects should improve its integration, collaboration, communication and coordination in the whole process to avoid any discrepancy in implementation of the contract. Alter and Hage (1993) determine coordination as a policy or procedure, which should be supported by organizational design principles. The coordination between parts of an organization is the method of their relationships. Therefore, the relationship between different groups of an organization can be improved through the proper coordination process. To effectively implement the contract, coordination between all parties is required to communicate and understand the underlying objectives, problems, and requirements. Keeping in view the importance of this aspect this study states that:

H4: Contract implementation is a significant coordination factor to impact the DB projectperformance

VE and Quality Assurance

Gelernter and Carriero (1992) defined coordination as the role of information exchange between active participants. It shows that coordination plays crucial roles in information sharing in pursuing the participants are in one direction to prevent conflicts of information. The result of proper coordination is a high quality of obtained information with less duplication leads to value enhancement and quality assurance. It is also noted that the purpose of coordination is an effective harmonization of the planned efforts for accomplishing goals. It is pointed out that the coordination will provide a win-win benefit for the project. In one way it will enhance the information database to detect problems and anomalies in the project activities and other ways it will create harmony among the participant to work as a team.

The VE and quality assurance are estimated by consistency to orders from the important architect and updating working projects. Remedial moves were made in the wake of illuminating/imparting examples of low quality and circumstances with pertinent gatherings (Wesam Salah Alaloul et al., 2016). Further, plan and details lucidity have honey bee estimated by rights/requirements and sufficient time and assets appointed for venture usage (Ismail et al., 2012). Additionally, on account of deformity or harm, medicinal work techniques, and re-executing programs are actualized in the undertaking (Wong and Vimonsatit, 2012). A quality affirmation plan is executed for the venture in accordance with a contract particular word combination (Enshassi et al., 2010). The administration and conveyance of off-site creation to the on-location work, plan adjustments, and change orders are composed. To distinguish absconds a legitimate channel of correspondence is actualized to assemble data on lacks/ambiguities (Jha and Iyer, 2006). The coordination in the VE and quality assurance is hypothesized as a significant factor to influence the DB project performance.

H5: VE and quality assurance significantly influence the DB project performance.

Technical Coordination

Complex projects face coordination challenges and difficulties. Therefore, many advancements in construction project management were introduced to solve the obstacles and avoid setbacks such as time and cost overruns, low quality, and disputes. "However, all the construction management and procurement systems are meaningless without proper coordination for technical support from head office. A vital managerial principle and activity, which provides the best cooperation among team members" (Hai et al. 2012, 1).

Task coordination program is intended to identify poor undertaking execution and staging of work the executives (Memon et al., 2014). In addition, input by the project team and undertaking director is constantly gathered for viable observing (Aibinu and Jagboro, 2002). Constant coordination for technical help from the head office is important (Isa et al., 2011). Insufficient technical support from the head office usually resulted from the poor coordination system between the project management team and head office. Project uncertainty, including both technical and requirements uncertainty, was found to negatively affect goal congruence and trust, as expected" (Liberatore and Luo 2010). Technical coordination is significant to find support on the technical issue of the project. Therefore, this study hypothesized that:

H6: Technical coordination is a critical factor for DB project performance.

Design Coordination

Coordination is usually not well understood, although it is a critical factor for construction projects (Chang and Shen 2009, 1). Chang stated that time and money usually are spent on coordination, but the level of performance in construction projects still is not as expected. Chang & Shen (2009) conducted a study on "Coordination Needs and Supply of Construction Projects". Shohet and Frydman (2003) as cited in (Chang and Shen 2009) noted that good communication and coordination are helpful for project performance.. An equal degree of interaction between designers and contractors leads to better project performance. Other researchers considered the coordination process in construction projects as important as construction and designs. Therefore, professionals should adopt the proper coordination process in construction projects. High quality and proper coordination among participants in construction projects will end up with a high project performance. A sufficient level of interaction between designers and constructors brings success to the overall project performance (Pocock et al. 1996). "coordination is more needed for such environment to build up teamwork and integration working environment, and it is fundamentally necessary for ensuring the success of a construction project" (Hai et al. 2012).

However, there is neither a model nor a practical way to tell the project manager how to better coordinate (Chang and Shen 2009). Chang's study established a model for coordination needs and the relationship between them to enable managers to understand the nature of the construction project and the required coordination process. Poor coordination and communication among project stakeholders were identified as common design waste causes across all project stages (Osmani 2013). The process of construction, depending on the complexity of the finished structure, requires a high level of coordination among all the professionals and trade persons from the design office to the construction site until the project is completed' (Hossain 2009, 2). In some cases, designs could be delayed due to improper coordination and scheduling between contractors, designers, and subcontractors. Therefore, a proper DC concurrence planning and execution mechanism are important.

The contractors repeatedly held the designers to a high standard of using economical materials or methods, which created time pressures and complicated the designers 'efforts to innovate and optimize the design or improve quality (Williams 1995). Incomplete or un-optimized design information increases cost (Terwiesch, Loch, and Meyer 2002). The designs should match the construction with no discrepancies and the construction team should be provided with required designs with no delay. Nevertheless, sometimes designs cannot catch up with construction progress, and often the designs don't match the construction requirements. The reason for this may be that the interviews were done in the early construction stage. In this stage, detailed designs usually are not finished, and the DC process was not operating properly. In some cases, designs could be delayed due to improper coordination and scheduling between contractors, designer, and subcontractors. Therefore, for a proper DC concurrence planning and execution mechanism, an efficient coordination platform is important. The design implementation and change of design required timely coordination between the designer, contractor, and project manager. This study corroborates that:

H7: Design coordination is a critical coordination factor that influences DB project performance.

Management Coordination

Complex projects face coordination challenges and difficulties. Therefore, many advancements in construction project management were introduced to solve the obstacles and avoid setbacks such as time and cost overruns, low quality, and disputes. "However, these construction management and procurement systems are meaningless without coordination, a vital managerial principle and activity, which provides the best cooperation among team members" (Hai, Yusof, Ismail, & Wei, 2012). Donini and Niland (1994) asserted that to secure a coordination atmosphere, it is of utmost importance to control coordination activities by management tools. Hossain (2009) argues that the potential importance, influence, and prominence of an actor is important indicators for a strong coordinator. It was found that the centrality of the coordination process had a very promising effect on the effectiveness of coordination (Hossain, 2009). The results There is a significant relationship between centrality and coordination. The management coordination is important to assign duties and monitor the project performance. Therefore, this leads to formulating the hypothesis;

H8: Management coordination is a significantly critical coordination factor to influence DB project performance.

External Coordination Factors

The outside elements additionally fundamentally influence the performance of construction projects. In this way, it is important to organize with the concerned specialists to stay away from any obstacle in the project which causes a significant set back for the performance of the project regarding cost or time (Enshassi, Mohamed, and Abushaban 2010). For example, the ecology office is constantly worried about air and commotion contamination because of development work. Hence, it is necessary to coordinate with the environment office to get an update regarding rules and regulations and permissions (Enshassi, Mohamed, and Abushaban

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2010). Additionally, the dumping of waste nearby is likewise a matter of worry for officials that need to comprehend. Therefore, any irregularity due to misinformation can cause big trouble and may affect the cost or speed of work. Also, getting permission from the municipality in the proper time and invigorated data on changes in law by the legislature can't be accomplished without an effective correspondence channel. Occasional assessment gatherings between the top administration, site workforce, the contractor and the staff is important to get testaments and examination by the outsider if necessary. Legitimate coordination and correspondence between the project leader and the lawful office are noteworthy to diminish the negative effect of outside variables.

Changes in regulations and laws by the government. This require proper coordination amongst the internal parties to adapt with the new laws. Similarly, Slow clearance on site due to restrictions. This requires good communication with external parties. Delays in issuing certification and inspection by a third party that needs good communication and coordination with external parties (Kumar 2016). External coordination factors also influence the performance of construction projects. The construction projects are bound to legal obligations and requirements of governmental authorities. Hence coordination among PM, contractor, designer, project team, the legal department is necessary to minimize any abnormalities in the projects with respect to governmental regulations. This study hypothesized that:

H9: External coordination factors significantly affect the performance of the DB construction project.

Project Performance

Estimation of factors affect the performance is an enteral theme of this research. Performance is an indispensable piece of the project and in this manner may have been practiced as far back as the project management exists. Performance estimation has been a point of discussion in a lot of research and consideration in the course of recent years. The deficiency of monetarily based performance estimation frameworks and the introduction of nonfinancial measures have been the triggers for quite a bit of this exploration. In this study, we estimate the performance of the design and build project by non-financial aspects. We estimate the performance of the design and build a project with ten dimensions of performance. Where the completion for design and build projects compared to the planned schedule has been found the most significant element of performance with a mean score of 4.42. The completion of design and build projects on schedule is an integral part of a project (Rahman et al. 2012). The construction projects have been graded as poor performance in Malaysia due to inefficient time management. The time overrun increase the cost which is a usual function of inflation. Projects failed due to improper time management have reportedly failed in other key performance areas like quality, efficiency and cost (Doloi et al. 2012).

The cost of the project has an integral part in the performance of a project. The efficient cost management for design and build projects according to the budget has been found significant with a mean score of 3.99. According to the Ministry of Statistics and Programme Implementation (MOSPI) India, 73% of failed projects are due to cost overrun (www.mospi.nic.in). Kim et al. (2008) and Odeh and Battaine (2002) rated the cost overrun as a single factor for the failure and success of the project. Doloi et al. (2012) rated the cost inefficiency as a critical factor for the performance of the project. Rahman et al. (2012)fond that 47% of the public and 37% of private projects in Malaysia were found to be failed due to cost overrun. Hence this study is significant to reveal the important coordination factors that influence the performance-related factors of construction projects. Moreover, the affect of coordination factors corresponds to the implication of the critical coordination factors in the DB projects of Malaysia.

III. METHODOLOGY AND DESIGN OF THE STUDY

This research employs a quantitative method to investigate the phenomenon under study. In pursuance of carrying out empirical analysis has been pursued to answer those questions raised by this study. This study focuses on the DB projects in Malaysia (public sector) and the target population is contractors and designers of DB projects, Malaysian Public Works Department (JabatanKerja Raya Malaysia- JKR) and Construction Industry Development Board (CIDB). It was difficult to know the total number of targeted DB projects due to the confidentiality issue by CIDB and JKR. A total of 301 questionnaires were distributed amongst targeted participants based on the Sekaran (2003) assumption (architects/ engineers, senior architects/ engineers, construction managers, project managers, and senior project managers) in construction companies, JKR and CIDB. The questionnaire has distributed either way: an online questionnaire and a hard copy questionnaire.

Research Instrument

The primary data for the study were collected through a survey method by using standardized structured questionnaires. The use of questionnaires is important and directly related to survey research (Babbie, 2004). The present research employed purpose-built instruments based on the literature review which had also been validated by estimating reliability and validity.

The first part of the research instrument seeks respondents' and institutional profiles. It contains statements asking about the respondent's job title, (Managers, Directors, Head of Departments, and, others. The demographic section also includes Email, and level of education (Ph.D., Master or bachelor's degree) and years of experience. Details of the respondents are at the beginning of the questionnaire to motivate them to respond to the questions. Sensitive details of respondents were avoided in the demographic section as much as possible. The second part of research instrument measured by nine critical dimensions, reflected by nine measured variables, namely: Scheduling and Planning Coordination, Human Resource Coordination, Documentation and Records Coordination, Contract Implementation Coordination, VE and Quality Assurance, Technical Coordination, Design Coordination, Management Coordination and External Coordination on Likert scale ranging from 1 to 5 be used for the collection of data where 1 represents "not critical" and 5 represents "most critical".

The final part of the questionnaire lists the parameters and measures of construction projects' performance. Performance parameters were listed on the scale from 1 to 5 where 1 is "poor" and 5 is "very good". By completing this task and collecting data, the performance of DB projects is evaluated. All questions being asked to the respondents are close-ended questions.

Data Analysis

When the survey data collected, codes are assigned to each respondent before the data enter into software for analysis. The data was analyzed using PLS-SEM software. Further, no- respondent characteristics were studied in order to check if the lack of response is significant. The collected data then summarized, analyzed, interpreted, and presented to address the research objectives that prompted the entire research process. The structural equation model (SEM) has been followed. The statistics employed to determine to a great extent by the design of the study and also by the types of measurement scale characterizing the dependent variable.

Evaluation of Outer Measurement Model

In the first step to calculate we estimate the outer model. For this purpose, we measure the validity, reliability and internal consistency of the measurement scale. The consistency of the construct has measured by reliability estimation using Cronbach's alpha (Ho 2006). The validity is measured by estimating the convergent validity and

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discriminant validity (Mohsini and Davidson 1992). The reliability of a single variable corresponds to the variance of individual respondent comparatively to an unobserved variable by evaluating the standardized outer loadings of the observed variables (Oliver, Liehr-gobbers, and Krafft 2010). The standard value to accept an observed variable is 0.7 or above (Joseph F. Hair, Ringle, and Sarstedt 2013). Any factor that has a loading score of less than 0.7 will be dropped from the model. Hence, for this investigation, we have selected a 0.70 loading score as a cut off value. Table 1 presents the factor loading schedule in detail.

TABLE I
Factor Loading for the coordination factors affecting DB project performance

Coordination Factors	**Code**	**Score**
Contract Implementation Coordination	CIC1	0.807
	CIC2	0.763
	CIC3	0.802
	CIC4	0.796
	CIC5	0.815
	CIC6	0.803
	CIC7	0.746
	CIC8	0.787
	CIC9	0.811
Design Coordination	DC1	0.865
	DC2	0.841
	DC3	0.814
	DC4	0.867
Documentation and Record Coordination	DR1	0.84
	DR2	0.808
	DR3	0.795
	DR4	0.795
	DR5	0.835
External Coordination Factors	ECF1	0.786
	ECF2	0.789
	ECF3	0.844
	ECF4	0.769
	ECF5	0.784
	ECF6	0.769
	ECF7	0.802
	ECF8	0.785
Human Resource Coordination	HRC 1	0.8
	HRC 10	0.773
	HRC 11	0.796
	HRC 12	0.763
	HRC 13	0.784
	HRC 2	0.812
	HRC 3	0.819
	HRC 4	0.803
	HRC 5	0.796
	HRC 6	0.756
	HRC 7	0.779
	HRC 8	0.779
	HRC 9	0.776
Management Coordination	MC1	0.804
	MC2	0.808
	MC3	0.805
	MC4	0.797
	MC5	0.79
	MC6	0.756
	MC7	0.801
	MC8	0.827
DB Project Performance	PP1	0.771
	PP10	0.802
	PP2	0.839
	PP3	0.844
	PP4	0.806

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	PP5	0.831
	PP6	0.813
	PP7	0.8
	PP8	0.825
	PP9	0.789
Scheduling & Planning	SP1	0.795
	SP10	0.766
	SP11	0.756
	SP12	0.792
	SP13	0.766
	SP2	0.809
	SP3	0.818
	SP4	0.788
	SP5	0.751
	SP6	0.753
	SP7	0.801
	SP8	0.776
	SP9	0.778
Technical Coordination	TC1	0.822
	TC2	0.85
	TC3	0.85
	TC4	0.874
VE & Quality Assurance	VQA 1	0.783
	VQA 2	0.808
	VQA 3	0.818
	VQA 4	0.86
	VQA 5	0.853
	VQA 6	0.833
	VQA 7	0.793
	VQA 8	0.766
	VQA 9	0.812

It can be seen from Table 1 that the range of outer loading is between 0.746 to 0.874. This illustrates that all the factors are within the acceptable range.

Reliability and Validity of Instrument

Before exploring and describing the relationship between coordination factors and organizational performance, it is necessary to gauge the extent of reliability and validity for each of the instrument uses in the study. Thus all the necessary tests have been carried out.

The reliability of a construct explains the consistency of responses while recording their responses which explains that the instrument was well developed and understood by respondents (Ary et al., 2002; Pallant, 2001). Thus, the Cronbach's alpha coefficients used to measure the internal consistency of a scale. Consistency of a measure shows that degree to which the measure is without error and subsequently offers a steady estimation for a particular concept and variables in the instrument (Sekaran, 2003). Ideally, the Cronbach α coefficient of a scale should be a least 0.7 (Hair, Anderson, Tathan, & Black 1995). However, it has to be noted that Cronbach α values are quite sensitive and are sometimes influenced by the number of items utilized to measure variables. Nunally's range for Cronbach alpha is 0.7, while Briggs and Cheek (1986) provide a standard range for Cronbach's alpha that is between 0.2 to 0.4. As indicated by Hair et al. (1995), satisfactory scopes of the reliability of most instruments run from 0.7 to 0.9. The closer the alphas to 1, the better the instrument.

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TABLEII
Reliability and Validity Results for Coordination Factors Affecting DB Project Performance

Coordination Factors	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Contract Implementation Coordination	0.926	0.938	0.628
DB Project Performance	0.943	0.951	0.660
Design Coordination	0.868	0.910	0.717
Documentation and Record Coordination	0.873	0.908	0.664
External Coordination Factors	0.915	0.931	0.626
Human Resource Coordination	0.949	0.955	0.620
Management Coordination	0.919	0.934	0.638
Scheduling & Planning	0.947	0.953	0.610
Technical Coordination	0.871	0.912	0.721
VE & Quality Assurance	0.937	0.947	0.664

A composite reliability estimation is a superior approach as compare to Cronbach's alpha to provides better results of internet consistency by retaining the loading of variables (Fornell and Larcker 1981). However, using both techniques simultaneously provides more robust results. Results show that the Cronbach's alpha score for all the variables is above 0.70 threshold level. Similarly, the CR score for all the variables is above the minimum level of 0.70 which alludes that construct is reasonably reliable. Further, we measure the average variance extracted (AVE) to confirm the concurrent legitimacy of the factors (Fornell and Larcker 1981). The most minimal half of the fluctuation from the observed variable ought to be taken by the latent constructs in the model. Henceforth, this demonstrates the AVE for all constructs ought to be above 0.5 (Joe F. Hair, Ringle, and Sarstedt 2011). From Table 2, it is seen that the whole of the AVE values were more than 0.5, so joined legitimacy was affirmed for this examination model. These outcomes affirmed the merged legitimacy and the great internal consistency of the estimation model.

3.3 Confirmatory Factor Analysis (CFA)

Validity prescribes trustworthiness and insinuates the match between a construct the way a researcher conceptualizes the idea in a hypothetical definition and a measure, it is portrayed by how much any evaluating instrument measures what it is relied upon to check (Salkind, 2000; Pallant, 2001; Sekaran, 2003; Hair et al. 2006). It insinuates how well an impeccable reality fits with honest to goodness reality (Neuman, 2003). Strong authenticity scores ensure that the things will use in the survey precisely to measure what they will intend to evaluate (Hair et al. 2006).

Content validity is an uncommon kind of face authenticity (Neuman, 2003). This authenticity creates requirements to do with how much the scale addresses the space of the thought under scrutiny (Neuman, 2003). Content validity is a component of how well the estimations and parts of a thought depict (Sekaran, 2003). In that capacity, it gets the entire significance. Measures should address all contemplations or zone in the hypothetical space (Neuman, 2003). Content validity is the sort of validity for which the affirmation is subjective and sensible rather than true (Bryman, 1988). In this study, we measured content validity by estimating

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confirmatory factor analysis which demonstrates that the estimations scale exhibits sensible validity to estimate the concept.

TABLE III
Fornell-Larcker Criterion for Discriminant Validity of Criticality Model

Coordination Factors	CIC	PP	DC	DR	ECF	HRC	MC	SP	TC	VQA
Contract Implementation Coordination	0.792									
DB Project Performance	0.435	0.812								
Design Coordination	0.245	0.384	0.847							
Documentation and Record Coordination	0.238	0.415	0.240	0.815						
External Coordination Factors	0.292	0.430	0.228	0.262	0.791					
Human Resource Coordination	0.245	0.420	0.234	0.267	0.263	0.788				
Management Coordination	0.265	0.410	0.240	0.254	0.253	0.277	0.799			
Scheduling & Planning	0.277	0.407	0.257	0.252	0.286	0.256	0.258	0.781		
Technical Coordination	0.237	0.392	0.247	0.277	0.263	0.270	0.265	0.271	0.849	
VE & Quality Assurance	0.272	0.372	0.273	0.261	0.265	0.265	0.219	0.251	0.270	0.815

TABLE IV
Cross-Loading for applicability model

	CIC	**PR**	**DC**	**DR**	**ECF**	**HRC**	**MC**	**SP**	**TC**	**VQA**
CIC1	0.807	0.342	0.19	0.174	0.242	0.237	0.217	0.239	0.189	0.196
CIC2	0.763	0.367	0.177	0.182	0.229	0.203	0.218	0.242	0.241	0.247
CIC3	0.802	0.328	0.188	0.188	0.205	0.23	0.261	0.195	0.202	0.217
CIC4	0.796	0.331	0.163	0.206	0.236	0.173	0.218	0.228	0.138	0.197
CIC5	0.815	0.345	0.217	0.191	0.252	0.201	0.194	0.189	0.204	0.2
CIC6	0.803	0.345	0.185	0.2	0.222	0.182	0.206	0.202	0.171	0.229
CIC7	0.746	0.36	0.227	0.127	0.229	0.191	0.224	0.218	0.138	0.202
CIC8	0.787	0.354	0.185	0.194	0.256	0.173	0.197	0.25	0.192	0.216
CIC9	0.811	0.32	0.209	0.245	0.208	0.151	0.151	0.206	0.215	0.231
DC1	0.195	0.307	0.865	0.164	0.221	0.206	0.2	0.211	0.191	0.246
DC2	0.208	0.301	0.841	0.204	0.172	0.18	0.191	0.196	0.213	0.229
DC3	0.208	0.338	0.814	0.236	0.203	0.191	0.2	0.223	0.215	0.237

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DC4	0.217	0.348	0.867	0.205	0.175	0.214	0.218	0.238	0.216	0.213
DR1	0.187	0.338	0.154	0.84	0.202	0.241	0.19	0.201	0.238	0.185
DR2	0.184	0.32	0.22	0.808	0.2	0.221	0.221	0.18	0.198	0.202
DR3	0.208	0.36	0.21	0.795	0.228	0.217	0.207	0.217	0.258	0.218
DR4	0.17	0.342	0.167	0.795	0.201	0.165	0.213	0.203	0.175	0.227
DR5	0.222	0.327	0.226	0.835	0.235	0.244	0.205	0.225	0.254	0.229
ECF1	0.232	0.354	0.214	0.203	0.786	0.174	0.214	0.256	0.233	0.174
ECF2	0.227	0.357	0.148	0.199	0.789	0.22	0.217	0.266	0.185	0.23
ECF3	0.254	0.381	0.224	0.189	0.844	0.233	0.179	0.203	0.207	0.23
ECF4	0.246	0.293	0.171	0.187	0.769	0.184	0.201	0.177	0.228	0.242
ECF5	0.214	0.377	0.185	0.205	0.784	0.201	0.202	0.219	0.205	0.202
ECF6	0.196	0.33	0.166	0.251	0.769	0.258	0.172	0.246	0.2	0.206
ECF7	0.242	0.314	0.179	0.207	0.802	0.179	0.2	0.223	0.188	0.21
ECF8	0.245	0.294	0.143	0.223	0.785	0.214	0.22	0.212	0.226	0.185
HRC1	0.166	0.349	0.135	0.223	0.226	0.8	0.267	0.194	0.24	0.227
HRC10	0.173	0.346	0.158	0.236	0.212	0.773	0.178	0.174	0.176	0.214
HRC11	0.199	0.35	0.177	0.227	0.201	0.796	0.226	0.203	0.18	0.217
HRC12	0.203	0.312	0.187	0.228	0.242	0.763	0.218	0.198	0.221	0.183
HRC13	0.177	0.339	0.198	0.2	0.191	0.784	0.208	0.212	0.238	0.219
HRC2	0.194	0.297	0.207	0.201	0.206	0.812	0.225	0.206	0.219	0.227
HRC3	0.219	0.365	0.208	0.224	0.196	0.819	0.231	0.183	0.206	0.218
HRC4	0.195	0.329	0.216	0.192	0.196	0.803	0.204	0.22	0.221	0.16
HRC5	0.211	0.317	0.149	0.233	0.198	0.796	0.225	0.212	0.229	0.219
HRC6	0.173	0.314	0.207	0.217	0.218	0.756	0.236	0.172	0.244	0.221
HRC7	0.19	0.335	0.193	0.216	0.179	0.779	0.211	0.224	0.147	0.192
HRC8	0.203	0.31	0.187	0.172	0.21	0.779	0.182	0.216	0.232	0.196
HRC9	0.208	0.324	0.178	0.156	0.221	0.776	0.227	0.215	0.224	0.216
MC1	0.238	0.318	0.183	0.172	0.2	0.202	0.804	0.21	0.224	0.211
MC2	0.243	0.335	0.188	0.203	0.21	0.232	0.808	0.215	0.206	0.171
MC3	0.211	0.321	0.232	0.185	0.21	0.205	0.805	0.209	0.209	0.149
MC4	0.198	0.353	0.213	0.254	0.177	0.216	0.797	0.2	0.193	0.206
MC5	0.174	0.326	0.17	0.189	0.202	0.277	0.79	0.194	0.253	0.123
MC6	0.199	0.294	0.154	0.16	0.216	0.236	0.756	0.229	0.206	0.134
MC7	0.174	0.315	0.151	0.222	0.209	0.194	0.801	0.151	0.208	0.187
MC8	0.253	0.352	0.232	0.229	0.198	0.213	0.827	0.238	0.194	0.208
PP1	0.349	0.771	0.293	0.324	0.38	0.336	0.31	0.293	0.285	0.277
PP10	0.341	0.802	0.335	0.327	0.335	0.33	0.352	0.335	0.281	0.286
PP2	0.364	0.839	0.333	0.353	0.321	0.338	0.325	0.344	0.341	0.339
PP3	0.357	0.844	0.324	0.329	0.397	0.348	0.324	0.349	0.351	0.324
PP4	0.314	0.806	0.298	0.33	0.34	0.37	0.301	0.329	0.335	0.283
PP5	0.397	0.831	0.286	0.33	0.354	0.347	0.328	0.339	0.31	0.292
PP6	0.357	0.813	0.324	0.361	0.376	0.331	0.341	0.337	0.303	0.311
PP7	0.377	0.8	0.298	0.281	0.295	0.295	0.326	0.309	0.313	0.268

PP8	0.349	0.825	0.309	0.355	0.378	0.39	0.395	0.334	0.341	0.345
PP9	0.326	0.789	0.318	0.375	0.313	0.32	0.326	0.335	0.324	0.292
SP1	0.235	0.328	0.18	0.204	0.218	0.233	0.239	0.795	0.2	0.194
SP10	0.202	0.314	0.175	0.223	0.251	0.219	0.174	0.766	0.168	0.204
SP11	0.211	0.307	0.181	0.218	0.264	0.214	0.208	0.756	0.203	0.209
SP12	0.226	0.349	0.242	0.19	0.235	0.164	0.226	0.792	0.203	0.239
SP13	0.191	0.333	0.264	0.199	0.232	0.202	0.229	0.766	0.203	0.234
SP2	0.197	0.276	0.218	0.214	0.193	0.187	0.157	0.809	0.181	0.167
SP3	0.257	0.305	0.16	0.22	0.247	0.215	0.183	0.818	0.217	0.184
SP4	0.209	0.329	0.203	0.18	0.268	0.18	0.174	0.788	0.247	0.151
SP5	0.267	0.302	0.193	0.193	0.188	0.172	0.194	0.751	0.187	0.194
SP6	0.18	0.325	0.22	0.191	0.208	0.213	0.181	0.753	0.213	0.207
SP7	0.214	0.32	0.236	0.22	0.213	0.19	0.239	0.801	0.228	0.196
SP8	0.228	0.3	0.153	0.144	0.178	0.195	0.204	0.776	0.278	0.163
SP9	0.196	0.331	0.176	0.165	0.196	0.217	0.196	0.778	0.224	0.194
TC1	0.178	0.339	0.22	0.228	0.212	0.232	0.198	0.273	0.822	0.232
TC2	0.192	0.33	0.23	0.249	0.261	0.206	0.24	0.247	0.85	0.208
TC3	0.236	0.328	0.191	0.233	0.224	0.266	0.218	0.206	0.85	0.25
TC4	0.201	0.336	0.198	0.23	0.198	0.214	0.242	0.194	0.874	0.227
VQA1	0.208	0.327	0.243	0.265	0.249	0.178	0.196	0.222	0.233	0.783
VQA2	0.19	0.32	0.221	0.199	0.223	0.245	0.183	0.208	0.199	0.808
VQA3	0.219	0.296	0.199	0.195	0.192	0.211	0.192	0.191	0.201	0.818
VQA4	0.226	0.285	0.206	0.202	0.207	0.228	0.139	0.221	0.24	0.86
VQA5	0.23	0.312	0.224	0.196	0.232	0.235	0.162	0.215	0.262	0.853
VQA6	0.287	0.336	0.212	0.231	0.223	0.246	0.219	0.223	0.243	0.833
VQA7	0.215	0.295	0.216	0.178	0.223	0.196	0.165	0.163	0.208	0.793
VQA8	0.196	0.256	0.243	0.188	0.185	0.212	0.197	0.207	0.179	0.766
VQA9	0.213	0.288	0.239	0.25	0.2	0.185	0.143	0.185	0.206	0.812

The further endeavor was the discriminant legitimacy of the constructs. Discriminant validity characterizes that the observed variable is different from the remaining constructs in the path model. It explains that the cross-loading score of a particular latent variable is higher as it could be in some other constructs (Sarstedt et al. 2014). The Fornell and Larcker measure was utilized to assess discriminant validity (Fornell and Larcker 1981). The accepted standard is that the variance of a construct ought not to be greater than its AVE score (Sarstedt et al. 2014). Table 3 shows the Fornell and Larcker measure trial of the coordination factors and Table 4 present the cross-loading score coordination factors. Table 3 shows that the entirety of the relationships was littler as comparative with the squared root of AVE, inferring good discriminant legitimacy for both models. This demonstrated the observed factors in each construct showed the given latent variable affirming the discriminant legitimacy of the model. Though, Table 4 shows that the cross-loading of every single observed variable was more than the inter-correlation of all the observed variables in the model. Accordingly, these discoveries affirmed the cross-loadings appraisal gauges and gave adequate approval to the discriminant legitimacy of the estimation model.

3.4 Evaluation of Inner Structural Model

We affirmed that the estimation model was legitimate and dependable. The subsequent stage was to gauge the Inner Structural Model results. This involved the significance of the model in predicting the proposed relationship and the association between the constructs. To evaluate the inner structural model we further estimate (R2) coefficient of determination, Path coefficient (b value) to estimate the overall model fitness and the effect of each observable variable. Moreover, the Goodness-of-Fit (GOF) index, Effect size (f^2), and predictive pertinence of the model (Q^2) have utilized as the key benchmarks for assessing the inner-model.

3.4.1 Estimation of the Coefficient of Determination

The R^2 is utilized to estimated the variance explained in the endogenous variable and explain the significance of the predictive ability of the construct. Higher the R^2 value higher the impact of latent variables can be translated into a change in the endogenous variable. For this study, the value of the coefficient of determination for the criticality model is 0.491 as presented in figure 1. This corresponds to the explanatory power of nine (09) coordination factors which are critical for the performance of DB projects. Similarly, the value of the coefficient of determination (R^2) for the applicability of coordination factors is 0.551 presented in figure 5.2. The R^2 value for both models is high which explains that critical coordination factors substantially explain the 49.1% of the variation in performance of DB projects while the applicability of coordination factors brings about 55.1% change in the performance of the DB project. As suggested by Henseler, Ringle, & Sinkovics (2009) and Hair et al. (2013) the value of R^2 greater than 0.6 is strong and substantially explains the impact of latent variables on the endogenous variable. Hence, the value of R^2 in our study for both model is substantial and explain the model in a precise way.

3.4.2 Estimation of Path Coefficients

The path coefficients estimated in PLS analysis are determined by the standardized beta (β) coefficient. The standardized beta (β) value tests the hypothesis that was established by the theory. Hence the coefficient explains the variation in the dependent variable due to one (1) unit variation in the independent variable. The beta (β) estimations of each path have been computed in PLS path coefficient estimation. The greater the value of (β) the more the significant impact on the endogenous variable is explained by the latent variable. In any case, the b esteem must be checked for its importance level through the T-insights test. The bootstrapping technique was utilized to assess the significance of the hypothesis (Vinzi et al. 2010). To test the significance of the path coefficient and T-test, we carried out a bootstrapping technique by iteration of 5000 subsamples was done for this investigation as introduced in Table 5 and 6.

TABLEV
Path Coefficient for Criticality of Coordination Factors

Hypothesized Path	**Standard Deviation**	**T Statistics**	**P Values**
Contract Implementation Coordination -> DB Project Performance	0.169	3.994	0.000
Design Coordination -> DB Project Performance	0.122	4.795	0.005
Documentation and Record Coordination -> DB Project Performance	0.145	3.358	0.001
External Coordination Factors -> DB Project Performance	0.155	3.636	0.000
Human Resource Coordination -> DB Project Performance	0.152	4.318	0.001
Management Coordination -> DB Project Performance	0.142	2.096	0.002

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Scheduling & Planning -> DB Project Performance	0.125	2.868	0.004
Technical Coordination -> DB Project Performance	0.106	3.586	0.010
VE & Quality Assurance -> DB Project Performance	0.085	3.036	0.042

To measure the impact of coordination factors for the performance of DB projects the results of hypothesized paths are presented in table 5. The firs path predicted that coordination for contract implementation significantly and positively affects the performance DB projects. The β value for contract implementation relevant coordination is 0.169 with a T-test value 3.99 having P<0.00. The results support the significant role of contract implementation coordination for DB project performance. Similarly, the criticality of design coordination for the performance of the DB project was tested and the beta value of 0.122 with 4.79 T-test value having 0.005 p-value. This also corroborates the significantly positive impact of design coordination in terms of criticality for DB project performance. Furthermore, documentation and record coordination has β value of 0.145 (t-value=3.35, p-value=0.001). This also shows the positive and significant impact of documentation and record coordination for DB project performance. In addition to this, the criticality of external coordination factors and human resource coordination factors also fund to be significantly and positively associated with the performance of DB projects having beta values of 0.155 and 0.152 respectively. The management coordination factors as also correspond the positive impact on the performance of DB projects having β score of 0.142 (t-value=2.09, p-value=0.002). Scheduling and planning coordination has β score of 0.125 (t-value=2.86, p-value=0.004). This explains the positive and significant impact of scheduling and planning coordination for the performance of DB projects. Technical coordination and VE & quality assurance have also been significantly and positively associated with DB performance (β=0.106 and 0.085 respectively). The higher value of β coefficients corresponds to the intensified role of latent variables on the exogenous construct. As illustrated in table 5 and figure 1, the most significant and critical coordination factors that affect the performance of DB projects is contract implementation having a beta value of 0.169 as compared to other coordination factors in the model. This can be understood as the contract implementation coordination explain the highest variation in the performance of DB projects. On the contrary, VE and quality assurance factors have the least beta coefficient value (β=0.089) which corresponds to the lowest impact of contract implementation factors on DB project performance. Figure 1 illustrates the graphical presentation of the criticality of coordination factors for DB project performance.

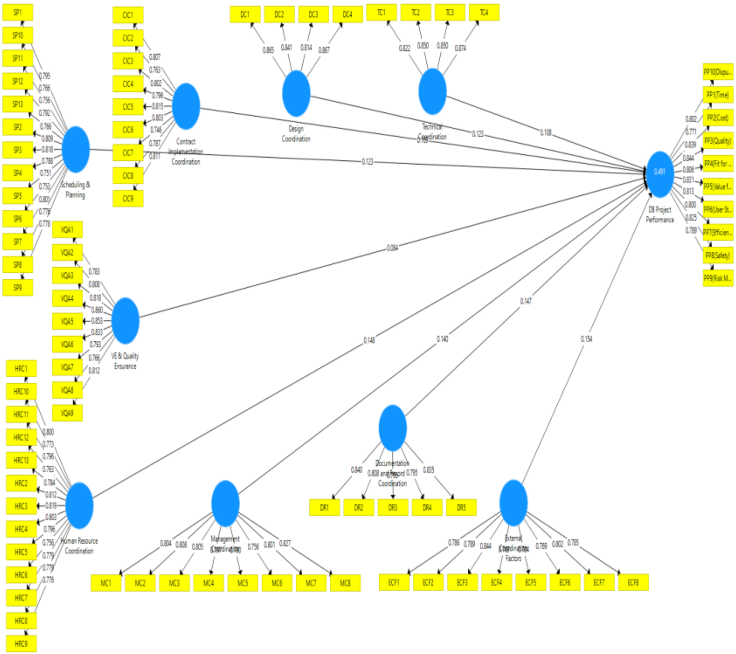

Fig.1. Assessment of Criticality Model

Estimation of Goodness of Fit (GOF)

To measure the fitness of the model in terms to explain the proposed framework, goodness of fit is used to measure the overall model fitness. The goodness of fit is an index containing values between 0 and 1. The values closer to zero are week and closer to 1 is understood as strong. The strong value explains that the model is parsimonious and plausible (Henseler, Hubona, and Ray 2016). The value of GOF is calculated by taking the square root of the product of the average of AVE of model and coefficient of determination (R2). Below equation 1 corresponds the Goodness-of-Fit (GOF) index.

$$\sqrt{R^2 * AverageCommunality(AVE)}$$

Eq (1)

TABLEVI

GOF Index for coordination factors

Coordination Factors	**Average Variance Extracted (AVE)**	**R^2**
Contract Implementation Coordination	0.628	0.491
DB Project Performance	0.660	
Design Coordination	0.717	
Documentation and Record Coordination	0.664	
External Coordination Factors	0.626	
Human Resource Coordination	0.620	
Management Coordination	0.638	
Scheduling & Planning	0.610	
Technical Coordination	0.721	
VE & Quality Assurance	0.664	
Average (AVE)	0.654	
R^2*Average (AVE)	0.321	

$\sqrt{R^2 * Average(AVE)}$	**0.567**	

Table 6 presents the GOP calculation for critical coordination factors that affect the performance of DB projects. The earlier has GOF index value 0.567 while the latter has got the GOP index value of 0.549. The values between 0.10-0.25 are considered as small. Values between the range of 0.25 and 0.36 are considered medium while values above 0.36 are explained as large to indicate the global validation of the path model. Hence, in our models, the GOF value is large and models are fit enough to explain the validation of the path model.

IV. CONCLUSION

The deliberations of the research findings focus to identify and develop a framework of coordination factors affecting the design and build project performance. The objective has been achieved by identifying the role of critical coordination factors in affecting construction projects' performance.In this study,we develop and analyze a framework to investigate the relationship between coordination factors and design and build project performance.

The major contribution of this study is to empirically reveal the construct that affects the performance of DB projects in terms of coordination by utilizing the PLS-SEM approach. The results of this study reveal some very interesting facets, by calculating the path coefficient for each latent exogenous variable to the endogenous variable. It is found that all the critical coordination factors have a significant positive impact on the performance of DB projects. Furthermore, the measurement of the applicability of critical success factors for DB project performance has also provided interesting results. It is found that the impact of the VE & Quality Assurance coordination factor has the least impact on the performance of the DB project. This shows that in practical, VE & Quality Assurance has less significance in terms of coordination to improve the performance of construction projects. The coordination for contract implementation has achieved the highest coefficient value which corroborates the most critical influential factor (0.169). The discoveries of this examination indicated that all proposed hypotheses are upheld, and the performance of DB projects is influenced by underlying coordination factors. Moreover, the relationship is statistically significant at the 0.05 level. The relationship of coordination factors with the performance of DB projects contends that inefficient coordination throughout the project specifically mentioned by underlying coordination factors is a significant aspect of project failureinMalaysia. More specifically, managers or contractors lack to apply the management coordination in DB projects which has a substantial influence on the performance of DB projects. This study has managerial by providing empirical evidence on the coordination-performance framewokand also provide theoretical implication for academia by exploring the new phenomenon in the construction projects.

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