International Business Research; Vol. 11, No. 2; 2018
ISSN 1913-9004 E-ISSN 1913-9012
Published by Canadian Center of Science and Education

Analysis of Critical Success Factors Influence on Critical Delays for Water Infrastructure Construction Projects in the Abu Dhabi emirate Using PLS-SEM Method

Jaafer Y. Altarawneh[1], Vinesh Thiruchelvam[2] & Behrang Samadi[1]

[1]Faculty of Business and Management, Asia Pacific University of Technology and Innovation (A.P.U), Malaysia

[2]Faculty of Computing, Engineering and Technology, Asia Pacific University of Technology and Innovation (A.P.U), Malaysia

Correspondence: Jaafer Y. Altarawneh, Faculty of Business and Management, Asia Pacific University of Technology and Innovation (A.P.U), Malaysia.

Received: November 30, 2017 Accepted: December 18, 2017 Online Published: January 8, 2018

doi:10.5539/ibr.v11n2p16 URL: https://doi.org/10.5539/ibr.v11n2p16

Abstract

The objective of this study is to investigate the significance impact of critical success factors on critical delays in the field of water infrastructure construction projects (WICPs) in the Abu Dhabi emirate in particular. Investigation was conducted utilizing quantitative approach by means of questionnaire survey to examine the understanding of professionals engaged in water infrastructure construction towards several critical success factors influencing critical delays. A total of 323 completed responses from owners, consultants and contractors representatives were gathered against 450 distributed questionnaires.

The gathered questionnaires were analysed using an advanced multivariate statistical method of Partial Least Square Structural Equation Modelling (PLS-SEM). Data analysis was conducted in two major phases. The first phase involved a preliminary analysis of the data, to ensure that the data adequately meet the basic assumptions in using SEM. The second phase applied the two stages of SEM. The first stage included the establishment of measurement models for the latent constructs in the research. After confirming the uni-dimensionality, reliability and validity of the constructs in the first stage, the second stage developed to test the research hypotheses through developing the structural models. The results indicated that Project Management Process (PMP), Project Manager's Competency (PMC), Project Team's member Competency (PTC), Project Organizational Planning (POP), Project Resources' Utilization (PRU) and Project Organizational Commitment (POC) had significant positive effects on Critical Delay Factor Evaluation (CDFS). From the results of moderation analysis revealed that Project Benchmark Characteristics (PBC) is positively moderate the effects of Project Management Process (PMP), Project Manager's Competency (PMC) and Project Team's member Competency (PTC) and Project Organizational Planning (POP) on Critical Delay Factor Evaluation (CDFS).

Keywords: Abu Dhabi, critical delay, critical success factors, structural equation modelling, PLS-SEM

1. Introduction

The construction industry in general and including water infrastructure sector is large, complex, volatile, risky, and requires tremendous capital outlays and tight money (Tumi, Omran & Pakir, 2009). It provides a bigger challenge to maintain its scheduled time, budgetary cost, and appropriate quality (Elawi, Algahtany & Kashiwagic, 2016). A prime critique coming up against the construction sector including water infrastructure construction projects is the increasing rate of occurred delays in construction project delivery (Tumi et al., 2009). From the available review, several studies have spotlight on identifying causes of project delays or critical success factors; however, none of the previous conducted studies have investigated relation among the critical success factors and critical delays in construction industry, in general, nor in water infrastructure construction projects in particular. Hence, this study adopted Structural Equation Modeling (SEM) to assess the influence of critical success factors on critical delays. The analysis selected PLS approach to Structural Equation Modeling (SEM) as this approach is more recommended and advised as most appropriate method for testing the causal relation (Hair, ringle & Sarstedt, 2011). In addition, according to Ng, Tang and Palaneeswaran (2010), Structural

Equation Modeling shows better functionality than other multivariate techniques including multiple regression, path analysis, and factor analysis.

2. Literature Review

2.1 Critical Delays Review

Numerous studies have questioned several dissimilar factors that lead to delay in various types of infrastructure construction projects. Generally; delay in construction projects is regarded as one of the most repeated difficulties in the construction field and it has an unfavorable impact on construction project success against time, cost, quality, and safety and no kind of construction projects has got out of the astounding ghost of time overruns (J. Sweis, Rateb Sweis, Abu Rumman, Abu Hussein & Dahiyat, 2013). The causes and impacts of delay factors in construction industry not only vary from project to project but also from geographical location to another due several reasons including and not limited to the environmental, the topographical and the technological constraints (Sweis, 2013; Shebob, Dawood & Shah, 2012). Shebob et al. (2012) mentioned in his study that in addition to country and projects variances in term of delay there is a certain projects are only a few days late while some projects are delayed by over a month or a year.

Kazaz, Ulubeyli and Tuncbilekli (2012) examined various causes of time delay in the context of Turkish construction industry and the levels of their significance, design and material changes, delay of payments and cash flow problems are the most predominant delay factors in Turkish construction industry. Motaleb and Kishk (2013) examined problems causing delays on construction projects in the United Arab Emirates; they investigated the causes and effects behind the delays that pertain to the delivery of construction projects in the United Arab Emirates, they identified and ranked the most key factors as follows: Change orders, Inadequate capabilities of client delegate, Delay in decision making by client delegate, Poor experience of client in construction, Insufficient management and supervision, Lack of experience of project team, Inflation/prices fluctuation, Poor time estimating, Construction materials delivery related problems, Improper project planning / scheduling, Imprecise cost estimating, High bank interest rate, Client's poor financial statement, Extravagant restriction to client ,Improper construction methods.

Elawi et al. (2016) investigated the reasons of the time delay in infrastructure projects in the Mecca province in Saudi Arabia. Their study concluded that factors contributed for the majority of time overruns were; land acquisition, contractor' lack of expertise, change order, and obtaining approvals and permits against underground utilities. Obodoh and Obodoh (2016) studied the major causes and effects of cost overrun and time delays in the infrastructure construction projects in Nigeria, the study revealed that, insufficient number of equipment, Imprecise time assessment, payment difficulties, change orders, poor cost estimate, inadequate site supervision and management, lack of modern equipment, shortage of construction materials, poor skills of project team, inaccurate project planning and scheduling and contractors' financial difficulties were the main causes of delay in Nigeria's construction projects. Durdyev, Omarov and Ismail (2017) studied causes of construction delay in infrastructure construction projects of residential nature in Cambodia, the study showed that shortage of materials on site, unrealistic project scheduling, late construction material delivery, shortage of competent labor, change orders, complexity of project, labor absenteeism, delay in payment by the owner against invoiced completed works, poor site management, delay by subcontractor, accidents due to inadequate site safety are ranked and evaluated by the representatives of two main stakeholders of contractors and consultants as the major causes of project delays in Cambodia.

From the presented literature review and many previous several researches, five (5) delays were identified as common in many studies in different geographical areas and various types of construction industries (Aziz & Abdel-Hakam, 2013; Alzaraa, Kashiwagib, Kashiwagic & Al-Tassand, 2016; Durdyev et al., 2017; Zidane, Johansenb & Ekambaramb, 2015; Elawi, 2016; Doloi, Sawhney & Iyer, 2012; Gunduz & AbuHassan, 2016; Gluszak & Lesniak, 2015; Gunduz, Nielsen & Ozdemir, 2015). The selected five delay factors are:

(1) Change scope, design and specifications,

(2) Material problem (supply vs availability),

(3) Financial difficulties (cash flow, currency),

(4) Poor productivity/ non-availability of Labor, and

(5) Poor communication and coordination among parties.

2.2 Critical Success Factors Review

Around the world, many researchers have been inspired to investigate project critical success factors. Toor and Ogunlana (2009) attempted to extract the understanding of construction experts on critical success factors (CSFs) pertained to construction projects of large-scale size in Thailand. Their study revealed that most of the high-rated CSFs are related to project planning and control, personnel, and involvement of client. However, the top ten CSFs according to the study were ranked as follows: effective project planning and control, sufficient resources, clear and detailed written contract, clearly defined goals and priorities of all stakeholders, competent project manager, adequate communication among related parties, competent team members, Knowing what client really wants, responsiveness of client and awarding bids to the right designers/contractors.

Tabish and Jha (2012) investigated important factors for success of construction projects pertains to public sector in India, the success factors resulted from this study were categorized into generic and specific natures, findings for generic type were: owners requirements need thorough understanding and precise definition, a high level of trust among the project bodies participants, on time and helpful decision from higher management, availability of all required resources as planned during all execution phases of project, top management's support, and consistent monitoring and feedback by higher management, while success factors of particular character were: thorough understanding of project manager and contractor on their part scope, comprehensive and thorough investigation of the project site in the pretender stage, regular and periodic monitoring and feedback by the owner representative, avoid bureaucratic interference, absent of social and political interferences , well identified and clear threaded scope of work, quality control and quality assurance activities, and adequate communication among all project participants. Mustaffa and Yong (2013) evaluated the severity-identified factors on construction project success distributed to clients, consultants and contractors. Their study identified fifteen (15) factors to be accepted as a critical to the success of construction projects and suggested a strong consistency in perception between respondents in recognizing the significance of human-related factors such as competence, commitment, communication and cooperation towards the success of a construction project. Thi and Swierczek (2010) have also studied causes of CSFs in Vietnam construction projects and their study revealed that manager competencies, member competencies and external stability have important positive relationships to the success criteria.

Gudienė, Banaitis, Podvezko & Banaitienėet (2014) conducted an empirical study in Lithuania to evaluate critical success factors for construction projects, based on the study results, ten factors including project manager competence, project management team members' competence, project manager coordinating skills, client clear and precise goals/objectives, project value, project management team members' relevant past experience, project manager organizing skills, project manager effective and timely conflict resolution, client ability to make timely decision, and project manager experience were determined as the most significant success factors for Lithuanian construction projects.

Several researchers have pointed out various findings about critical success factor in construction projects such as Gunduz and Yahya (2015) conducting a study aimed to determine the critical success factors in the construction industry in Middle East region and in the United Arab Emirates market specially. These factors were evaluated for their influence and contribution to the real performance of the project from the perspective of three criteria: schedule, cost, and quality. Mukhtar, Amirudin, Sofield & Mohamad (2016) investigated success factors in public housing projects in Nigeria and serves as a guide reference to housing policy makers. The study identified seven CSFs for public housing projects in Nigeria, these factors are; availability of competent personnel, effective project management, proper design and appropriate location, powerful financing system for housing, and sufficient political support.

A number of studies were conducted to identify the project critical success factors. Some studies investigated the impact of technical factors such as scope and work definition as well as planning. Other body of research studied the effect that different stakeholders may have on the project outcome; i.e. commitment, team capabilities, project manager capabilities and commitment (Mustaffa & Yong, 2013; Babu, 2015; Cserháti & Szabó, 2014). Some researchers studied the project management techniques and the effect of team members, team motivation and personnel selection and training (Banihashemi, Hosseini, Golizadeh & Sankaran, 2017; Amade, Ubani, Omajeh & Njoku, 2015; Gunduz & Yahya, 2015; Zou, Kumaraswamy, Chung & Wong, 2014; Wibowo & Alfen, 2014). Others investigated the impact of so skills such as communication between different stakeholders, or external factors that might affect the project success, such as political conflict and corruption, rough climate characters and environment, unexpected conditions (Babu, 2015; Zavadskas, Vilutiene, Turskis & Saparauskas, 2014; Ihuah, Tippett & Eaton, 2014; Shehu, Endut, Akintoye and Holt, 2014; Marzouk & El-Rasas, 2014;

Wibowo and Alfen, 2014; Gudienė, Banaitisa, Banaitienėa & Lopesb, 2013; Yong & Mustaffa, 2013; Gudienė et al., 2014).

Based on an analysis of the literature that has been outlined earlier, it has become apparent that there is a plenty of factors with the potential to influence the project success. However, according to Altarawneh, Thiruchelvam & Samadi (2017), due to their frequent use in previous studies and because much researches were concluded their studies results by them in some way, the six most significant success factors in determining project success identified by various number of researchers and their attributes have been chosen for further investigation in this study are listed in Table 1.

Table 1. Critical Success Factors (CSFs) and their attributes

Group/Construct	*Item*	Item Description
Project Management Process (PMP)	PMP1	Detailed engineering plans and all drawings are timely finalized
	PMP2	Contractual motivation/incentives clause exists for early
	PMP3	Thorough prequalification for bidders
	PMP4	Scope of work was clearly articulated
	PMP5	Comprehensive pretender site investigation carried out
Project Manager's Competency (PMC)	PMC1	Project Manager (PM) are selected early with proven track record
	PMC2	PM have similar project experience
	PMC3	PM have coordinating ability and rapport with owner, contractor,
	PMC4	There is a thorough understanding of scope between PM and
	PMC5	PM displayed a sense of power and confidences in decisions
Project Team's member Competency	PTC1	Project Team Member (PTM) competences such as knowledge,
	PTC2	PTM have the sufficient knowledge to make various quick
	PTC3	There is adequate communication among PTMs
	PTC4	Conflict is resolved quickly by PTMs
	PTC5	PTM has the aptitude to take an active part in the monitoring and
Project Organizational Planning (POP)	POP1	Timely valuable decisions are received from top management
	POP2	PM for the project and staff had given timely valuable decisions
	POP3	Design and construction control meetings are conducted
	POP4	Regular schedule and budget updates are taken
	POP5	Adequate staff is available for planning
Project Resources' Utilization (PRU)	PRU1	Contractor utilized up-to-date technology
	PRU2	Regular quality control and quality assurance activities are
	PRU3	Resources are available (fund, machinery, material etc,) as planned
	PRU4	Adequate staff are available for execution
	PRU5	The pre-qualification of the consultant and/or bidder are done
Project Orginisational Commitment (POC)	POC1	Owner is committed to release payments within 45 days of
	POC2	PM is committed against goals/objectives set to meet project
	POC3	PM is committed to project compliance in accordance to owner's
	POC4	PTMs are committed to zero accident achievement during
	POC5	Contractor is committed to zero variation orders

2.3 Moderator Factors Review

In addition to the critical success factors that have been identified in the literature, the impact of two other moderate factors has been investigated, Project Benchmark Characteristics (PBC) and Project External Environments (PEE), which are believed to affect the relationship between the critical success factors and project critical delays (Park, 2009; Tan & Ghazali, 2011; Yang, Huang & Wu, 2011; LI, Arditi & Wang, 2012; Gudienė et al., 2013; Yong & Mustaffa, 2013; Gudienė et al., 2014). In the available literature, project Benchmark characteristics and project external environments have long been disregarded as being critical success factors; however, many construction projects witnessed status of failure due to problems within projects (Thi and Swierczek, 2010).

Several researchers underpin ‘environment’ factors influencing the construction project success (Ahsan & Gunawan, 2010; Tan and Ghazali, 2011; Zawawi, Kamaruzzaman, Ithnin & Zulkarnain,, 2011; Windapo and Cattell, 2013; Gudienė et al., 2013; Gudienė et al., 2014; Ihuah et al., 2014; Shehu et al., 2014; Marzouk & El-Rasas, 2014; Wibowo and Alfen, 2014). Further, Jin, Tan, Zuo and Feng (2012) described ‘environment’ as all external issues effects on the construction project process, including and not limited to social, political, and technical systems. The factors that can be grouped into these categories include economic environment, social environment, political environment, physical environment, industrial relation environment, and level of technology advanced (Jin et al., 2012).

This external environmental factor contains several items, which are external to the project but have an influence on the construction project performance, either positively or negatively (Thi and Swierczek, 2010). A number of external environmental factors, such as economic, political, legal, social and those factors linked to new technologies or even factors related to nature, may influence construction project performance (Hwang, Zhao & Ng, 2013). However, according to Jin et al. (2012), some of these externals influence the construction project at all phases of the project life cycle, such as weather conditions or the social environment. According to some researchers, these factors sometimes, have a considerable impact that they resulted in project termination at the construction stage (Jin et al., 2012; Yong and Mustaffa, 2013; Zhao et al., 2013; Gudienė et al., 2014).

According to several researchers, project size, value, uniqueness of project activities, the density of project and project urgency were specified as major critical success factors within the project (Ng, Wong & Wong, 2012; Gudienė et al., 2013; Zhao et al., 2013; Gudienė et al., 2014; Yang et al., 2015; Shehu et al., 2014; LI et al., 2012; Yong & Mustaffa, 2013; Tan & Ghazali, 2011). In addition to that, Gudienė et al (2014) pointed out that several large construction projects that contain more than 100 activities exceed their contractual deadlines. Also, several researchers highlighted that; the project manager’s performance in the work can be significantly affected by the uniqueness of the construction activities (LI et al., 2012; Gudienė et al., 2013; Yong & Mustaffa, 2013; Gudienė et al., 2014). They believed that, it is easier for project managers to plan, schedule and monitor construction project activities if a project has tasks that are more standard rather than complex activities. According to them, Project density also affects the overall performance. That is, will influence the allocation of project resources, including man-hours and machineries. In a way, due to imposed resource constraints, project managers are often constrained to implement overtime procedures, which lead to exceed the allocated budget, or they are strained to delay activities running for the same manpower resources, which cause delays in project completion. Some researchers related urgency to project success (Gudienė et al., 2014). On the other hand, project performance criteria for some cases are not met due to the urgency impact (Yang et al., 2011; LI et al., 2012). From the presented literature review and many previous several researches, two moderator factors were identified in several studies and listed with their attributes in Table 2.

Table 2. Moderator factors and their attributes

Group/Construct	*Item*	Item Description
Project Benchmark Characteristics (PBC)	PBC1	High value of project
	PBC2	Large size of project (team numbers involved and number of
	PBC3	Complexity and uniqueness of project activities
	PBC4	The urgency of project outcome
	PBC5	The type of project (new, existing, maintenance)
Project External Environments (PEE)	PEE1	Physical environment problems like (location, soil works,
	PEE2	Natural climates problems like winds, rains, high humidity and
	PEE3	Social and cultural interference (population demographics, rising
	PEE4	Economic and financial problems (price, local currency value,etc.)
	PEE5	Bureaucratic interference

3. Research Hypothesis

Following the conduct of thorough and intensive literature review, codes and description of the research hypotheses are represented in Table 3.

Table 3. Research Hypotheses Codes and Descriptions

Code	*Description*	Path
Direct Effect of Constructs		
H1	Project Management Process (PMP) has a positive effect on Critical Delay Factor Evaluation (CDFS)	PMP → CDFS
H2	Project Manager's Competency (PMC) has a positive effect on Critical Delay Factor Evaluation (CDFS)	PMC → CDFS
H3	Project Team's member Competency (PTC) has a positive effect on Critical Delay Factor Evaluation (CDFS)	PTC → CDFS
H4	Project Organizational Planning (POP) has a positive effect on Critical Delay Factor Evaluation (CDFS)	POP → CDFS
H5	Project Resources' Utilization (PRU) has a positive effect on Critical Delay Factor Evaluation (CDFS)	PRU → CDFS
H6	Project Organizational Commitment (POC) has a positive effect on Critical Delay Factor Evaluation (CDFS)	POC → CDFS
Moderation Effects of Project Benchmark Characteristics (PBC)		
H7a	Project Benchmark Characteristics (PBC) moderates the relationship between Project Management Process (PMP) and Critical Delay Factor Evaluation (CDFS)	(PMP*PBC) → CDFS
H7b	Project Benchmark Characteristics (PBC) moderates the relationship between Project Manager's Competency (PMC) and Critical Delay Factor Evaluation (CDFS)	(PMC*PBC) → CDFS
H7c	Project Benchmark Characteristics (PBC) moderates the relationship between Project Team's member Competency (PTC) and Critical Delay Factor Evaluation (CDFS)	(PTC*PBC) → CDFS
H7d	Project Benchmark Characteristics (PBC) moderates the relationship between Project Organizational Planning (POP) and Critical Delay Factor Evaluation (CDFS)	(POP*PBC) → CDFS
H7e	Project Benchmark Characteristics (PBC) moderates the relationship between Project Resources' Utilization (PRU) and Critical Delay Factor Evaluation (CDFS)	(PRU*PBC) → CDFS
H7f	Project Benchmark Characteristics (PBC) moderates the relationship between Project Organizational Commitment (POC) and Critical Delay Factor Evaluation (CDFS)	(POC*PBC) → CDFS
Moderation Effects of Project External Environments (PEE)		
H8a	Project Benchmark Characteristics (PBC) moderates the relationship between Project Management Process (PMP) and Critical Delay Factor Evaluation (CDFS)	(PMP*PEE) → CDFS
H8b	Project Benchmark Characteristics (PBC) moderates the relationship between Project Manager's Competency (PMC) and Critical Delay Factor Evaluation (CDFS)	(PMC*PEE) → CDFS
H8c	Project Benchmark Characteristics (PBC) moderates the relationship between Project Team's member Competency (PTC) and Critical Delay Factor Evaluation (CDFS)	(PTC*PEE) → CDFS
H8d	Project Benchmark Characteristics (PBC) moderates the relationship between Project Organizational Planning (POP) and Critical Delay Factor Evaluation (CDFS)	(POP*PEE) → CDFS
H8e	Project Benchmark Characteristics (PBC) moderates the relationship Project Resources' Utilization (PRU) and Critical Delay Factor Evaluation (CDFS)	(PRU*PEE) → CDFS
H8f	Project Benchmark Characteristics (PBC) moderates the relationship Project Organizational Commitment (POC) and Critical Delay Factor Evaluation (CDFS)	(POC*PEE) → CDFS

4. Research Model

In order to specify the research hypotheses targeted in Table 3, a research structural model was developed in this study. The research structural model is intended to test 6 hypotheses related to direct effects from (PMP), (PMC), (PTC), (POP), (PRU) and (POC) on Critical Delay Factor Evaluation (CDFS).The study also examined the moderation effects of (PBC) and (PEE) on the relationships of the other constructs. Figure 1 illustrates the hypothesized direct and moderation effects in the research structural model.

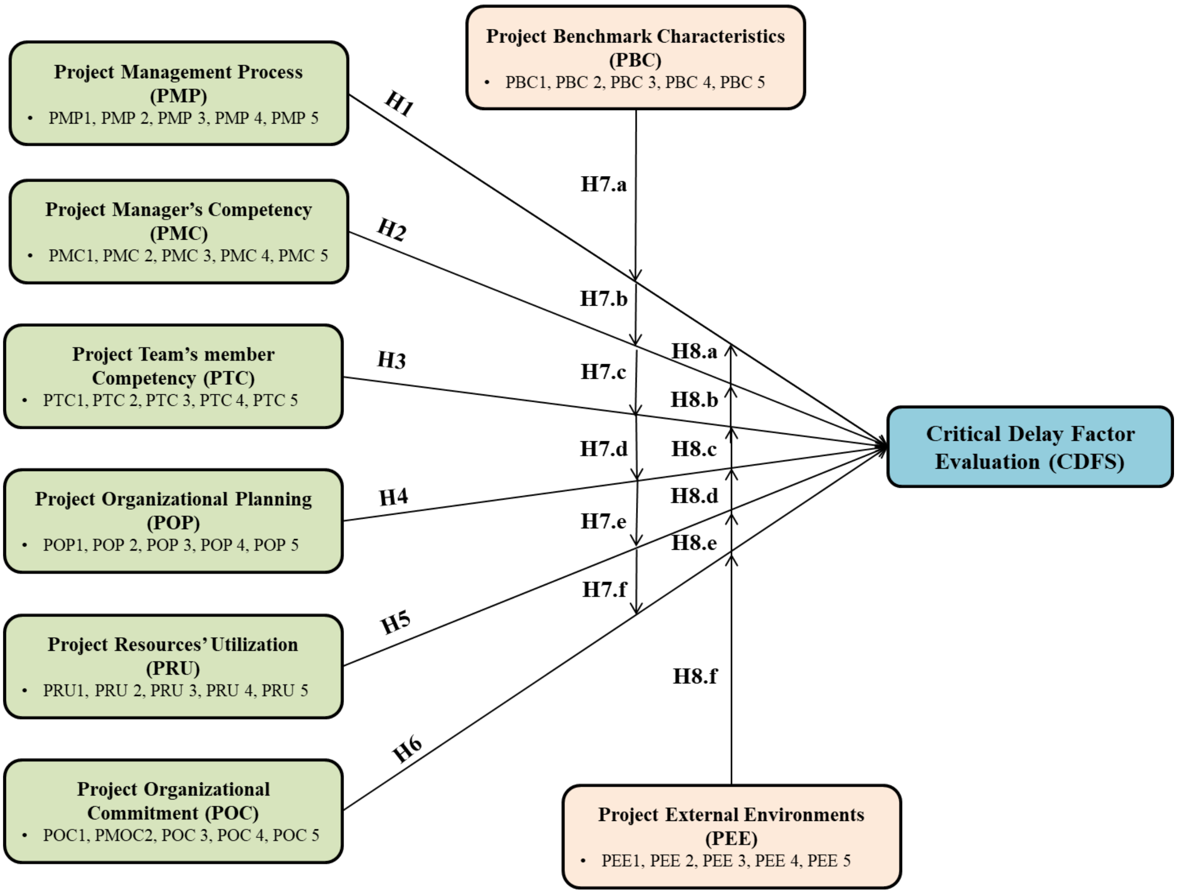

Figure 1. Hypothetical model

The factors are known as exogenous latent variables meanwhile the items are known as relative manifest variables. The details of the exogenous latent and relative manifest variables of the adopted model are shown in Table 1 &2.

5. Research Method

This study followed quantitative research approach including data collection by means of structured questionnaire survey. The survey was conducted between main owners of water projects, qualified consultants and contractors registered in the vender's list of the main owners who are either handle or conduct all released projects for the last ten years. A total number of 450 questionnaires were released between the selected companies (owners, consultant & contractors). As a result, 323 completed questionnaires were returned back by the participants. The collected questionnaires were analysed using SPSS software for evaluate the received questionnaires against the demographic information of the respondents as summarized in Table 4.

Table 4. Demographic information of respondents

Group	*Frequency*	Percentage
Experience		
5-12 years	94	29.1
13-20 years	166	51.4
More than 20 years	63	19.5
Age		
21-30 years	33	10.2
31-40 years	105	32.5
41-50 years	119	36.8
51-60 years	44	13.6
Above 61 years	22	6.8
Area		
Construction Management	51	15.8
Architectural	20	6.2
Civil & Structure (C&S)	128	39.6
Mechanical & Electrical (M&E)	105	32.5
Quantity Surveyor (QS)	19	5.9
Role		
Client/Owner	114	35.3
Consultant/Engineering	39	12.1
Contractor	170	52.6
Education		
Diploma	18	5.6
Bachelor degree	242	74.9
Master degree	52	16.1
Ph.D.	11	3.4

6. Overall CFAModel

As highlighted earlier, structural equation, modelling is a data analytic technique commonly used to examine patterns of relationships among constructs (Cooper & Schindler, 2006). The latent constructs in individual CFA models were all measured by several multi-item scales. The inclusion of all items and relative errors in the measurement and structural models leads to a complex and non-stable model because too many parameters need to be estimated. Thus, to overcome this problem, this research utilised parcels as indicators of latent constructs in individual CFA models. Parcels are aggregations (sums or averages) of several individual items. Using parcels as indicators of latent construct commonly have better reliability as compared with the single items (Coffman & MacCallum, 2005). As the result of using item-parcelling procedure, the latent constructs in individual CFA models of (PMP), (PMC), (PTC), (POP), (PRU), (POC), (PBC) and (PEE) were converted into observed variables so that they could easily construct the overall measurement and structural model and reduce the model complexity.

Confirmatory factor analysis was used to assess the overall measurement model. The model comprises all of the first and second order constructs proposed in this study. Figure 2 depicts the overall CFA model.

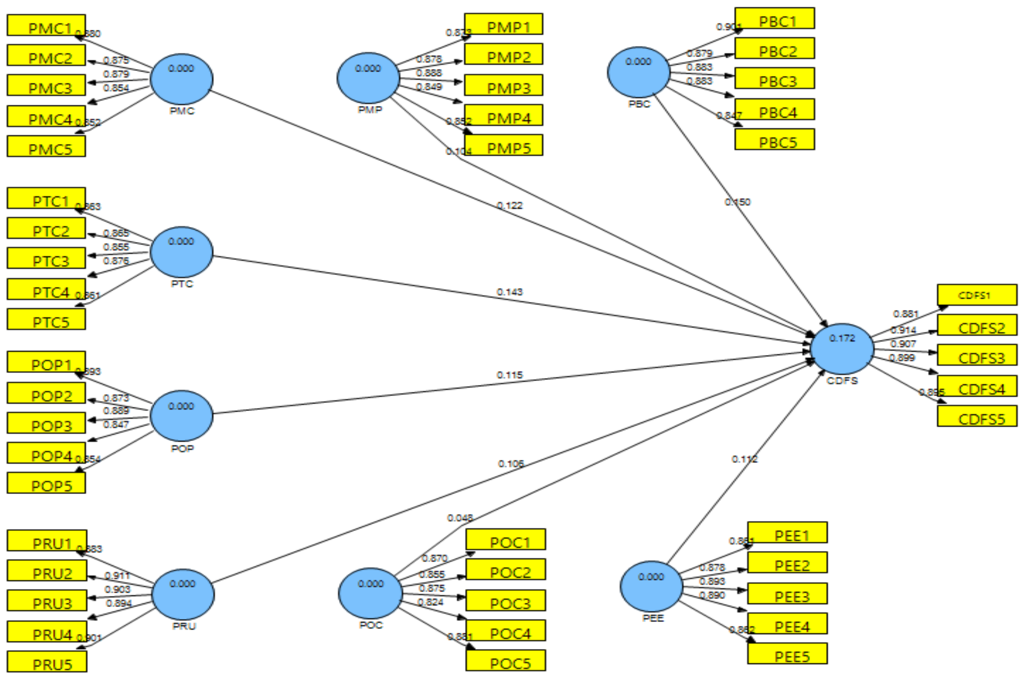

Figure 2. Overall CFA Model

6.1 Reliability and Convergent Validity

Table 5 represents the result of Cronbach alpha and convergent validity for the Overall CFA model.

Table 5. Results of Cronbach Alpha and Convergent Validity for Overall CFA Model

Construct	*Item*	Factor	Average Variance	Composite Reliability	Internal
Project Management Process (PMP)	PMP1	0.873	0.754	0.939	0.919
	PMP2	0.878			
	PMP3	0.888			
	PMP4	0.849			
	PMP5	0.852			
Project Manager's Competency (PMC)	PMC1	0.880	0.754	0.939	0.919
	PMC2	0.875			
	PMC3	0.879			
	PMC4	0.854			
	PMC5	0.852			
Project Team's member Competency (PTC)	PTC1	0.863	0.746	0.936	0.915
	PTC2	0.865			
	PTC3	0.855			
	PTC4	0.876			
	PTC5	0.861			
Project Organizational Planning (POP)	POP1	0.893	0.759	0.940	0.921
	POP2	0.873			
	POP3	0.889			
	POP4	0.847			
	POP5	0.854			
Project Resources' Utilization (PRU)	PRU1	0.883	0.807	0.954	0.941
	PRU2	0.911			
	PRU3	0.903			
	PRU4	0.894			
	PRU5	0.901			
Project Organizational Commitment (POC)	POC1	0.870	0.742	0.935	0.914
	POC2	0.855			
	POC3	0.875			
	POC4	0.824			
	POC5	0.881			
Project Benchmark Characteristics (PBC)	PBC1	0.901	0.773	0.944	0.926
	PBC2	0.879			
	PBC3	0.884			
	PBC4	0.883			
	PBC5	0.847			
Project External Environments (PEE)	PEE1	0.861	0.769	0.943	0.925
	PEE2	0.878			
	PEE3	0.893			
	PEE4	0.890			
	PEE5	0.862			
Critical Delay Factor Evaluation (CDFS)	CDFS1	0.881	0.809	0.955	0.941
	CDFS2	0.914			
	CDFS3	0.907			
	CDFS4	0.899			
	CDFS5	0.895			

[a]: Average Variance Extracted = (summation of the square of the factor loadings)/{(summation of the square of the factor loadings) + (summation of the error variances)}.

[b]: Composite reliability = (square of the summation of the factor loadings)/{(square of the summation of the factor loadings) + (square of the summation of the error variances)}.

As shown in Table 5, the results of assessing the standardized factor loadings of the model's items indicated that the initial standardised factor loadings of items were all above 0.6, ranged from 0.824 to 0.914.

Once the uni-dimensionality of the constructs was achieved, each of the constructs was assessed for their reliability. Reliability is assessed using average variance extracted (AVE), construct reliability (CR) and

Cronbach's alpha. Table 5 shows that the AVE values were 0.754, 0.754, 0.746, 0.759, 0.807, 0.742, 0.773, 0.769 and 0.809 for (PMP), (PMC), (PTC), (POP), (PRU), (POC), (PBC), (PEE) and Critical Delay Factor Evaluation (CDFS) respectively. All of these values were above the cut-off 0.5 as suggested by Hair et al. (2006).

The composite reliability values were 0.939, 0.939, 0.936, 0.940, 0.954, 0.935, 0.944, 0.943 and 0.955 for (PMP), (PMC), (PTC), (POP), (PRU), (POC), (PBC), (PEE) and (CDFS) respectively. These values exceeded the recommended value of 0.6 for all constructs as recommended by Bagozzi and Yi (1988).

The Cronbach's Alpha values were 0.919, 0.919, 0.915, 0.921, 0.941, 0.914, 0.926, 0.925 and 0.941 for (PMP), (PMC), (PTC), (POP), (PRU), (POC), (PBC), (PEE) and Critical Delay Factor Evaluation (CDFS) respectively. These values were all above the threshold of 0.7 as suggested by Nunnally and Bernstein (1994).

6.2 Discriminant Validity

Table 6 represents the discriminant validity of the Overall CFA Model.

Table 6. Discriminant validity of Overall CFA Model

	PMP	PMC	PTC	POP	PRU	POC	PBC	PEE	CDFS
PMP	**0.868**								
PMC	0.063	**0.868**							
PTC	0.115	0.056	**0.864**						
POP	0.067	0.012	0.138	**0.871**					
PRU	0.227	0.135	0.067	0.129	**0.898**				
POC	0.079	-0.074	0.046	0.043	0.096	**0.861**			
PBC	0.120	0.083	-0.018	0.097	0.043	0.096	**0.879**		
PEE	0.054	0.034	0.083	0.177	0.087	0.131	0.283	**0.877**	
CDFS	0.188	0.165	0.193	0.193	0.192	0.098	0.222	0.212	**0.899**

Note: Diagonals represent the square root of the average variance extracted while the other entries represent the square correlations.

The inter-correlations between the 9 sub-constructs in Overall CFA Model ranged from -0.074 to 0.283, which were below the threshold 0.85 as recommended by Kline (2005). Further, as shown in Table 20 4, the correlations were less than the square root of the average variance extracted by the indicators, demonstrating good discriminant validity between these factors (Kline, 2005). Upon examining goodness to fit of data, convergent validity and discriminant validity of the measurement model, it can be concluded that modified measurement scale to assess the constructs and their relative items in overall measurement model was reliable and valid.

7. Structural Models

The structural equation model is considered as the second major process of structural equation modeling analysis. Once validation process of the measurement model is confirmed, then representation of the structural model can be established by identifying the relationships between the constructs. The structural model provides details on the links between the variables (Nafisi, A. & Nafisi, S., 2015). It displays the particular details of the relationship among the independent or exogenous and dependent or endogenous variables (Hair, et al., 2006; Ho, 2006). Evaluation of the structural model spotlight firstly on the overall model fit, followed by the size, direction and significance of the hypothesized parameter estimates, as shown by the one- headed arrows in the path diagrams (Hair, et al., 2006). The final part included the confirmation process of the structural model of the study, which was established on the projected relationship among the identified and assessed variables. In the present study, the structural model was supposed to test the research hypothesizes, utilizing PLS method and bootstrapping with 1000 replications.

The next sub-sections discuss the development of structural model to test the research hypotheses described in Table 3.

7.1 Direct Effects of Constructs

In the structural model, the direct causal effects of (PMP), (PMC), (PTC), Project Organizational Planning (POP), (PRU) and (POC) on Critical Delay Factor Evaluation (CDFS) were examined. These effects refer to the 6 hypotheses namely: H1, H2, H3, H4, H5 and H6 respectively. The Smart-PLS model is portrayed in in Figure 3.

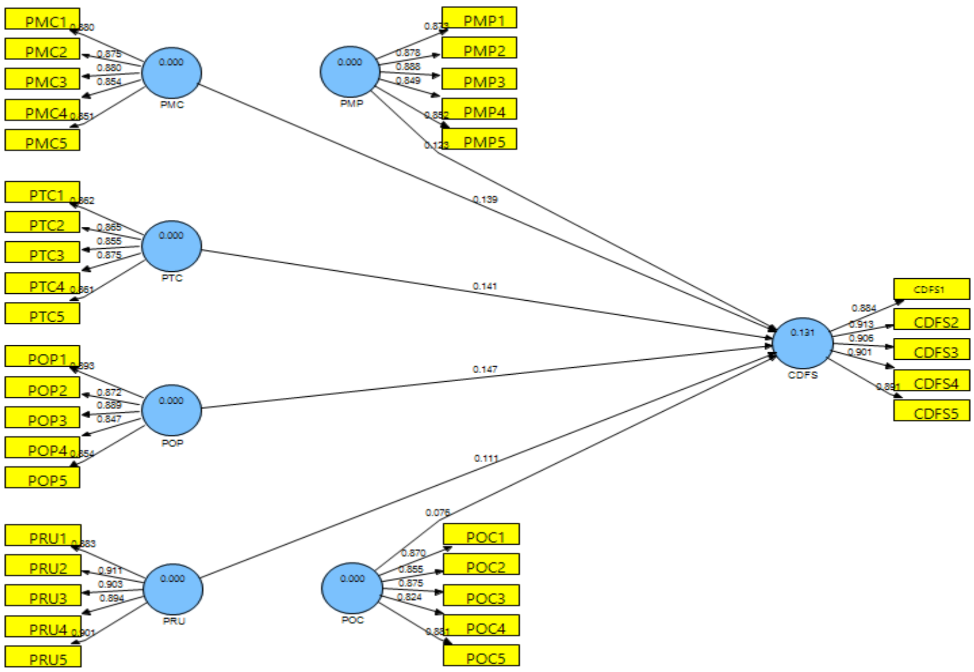

Figure 3. PLS Analysis of the Structural Model for Direct Effects

The value of R2 for Critical Delay Factor Evaluation (CDFS) was 0.172. This indicates, 17 percent of variations in Critical Delay Factor Evaluation (CDFS) are explained by its 6 predictors (i.e, (PMP), (PMC), (PTC), (POP (PRU) and (POC)). Overall findings showed that the R^2value satisfies the requirement for the 0.30 cut off value as recommended by Patterson (2013). The values of Q2 for Critical Delay Factor Evaluation (CDFS) was 0.129, far greater than zero, which refers to predictive relevance of the model as suggested by Chin (2010). In sum, the model exhibits acceptable fit and high predictive relevance.

The coefficient parameters estimates are then examined to test the hypothesized direct effects of the variables, which were addressed in Table 3. The path coefficients and the results of examining hypothesized direct effects are displayed in Table 7.

Table 7. Examining Results of Hypothesized Direct Effects of the Constructs

Path Shape	*Path Coefficient*	Standard Error	T-value	P-value	Hypothesis Result
PMP → CDFS	0.123^{***}	0.028	4.361	0.000	H1) Supported
PMC → CDFS	0.139^{***}	0.025	5.541	0.000	H2) Supported
PTC → CDFS	0.141^{***}	0.026	5.348	0.000	H3) Supported
POP → CDFS	0.147^{***}	0.023	6.496	0.000	H4) Supported
PRU → CDFS	0.111^{***}	0.025	4.351	0.000	H5) Supported
POC → CDFS	0.076^{*}	0.033	2.266	0.024	H6) Supported

*p< 0.05, **p< 0.01, ***p< 0.001

As shown in Table 7, all paths from (PMP), (PMC), (PTC), (POP), (PRU) and (POC) to Critical Delay Factor Evaluation (CDFS) were statistically significant as their p-values were all below the standard significance level of 0.05. Thus, the hypotheses H1, H2, H3, H4, H5 and H6 were supported.

7.2 Moderation Effects of Project Benchmark Characteristics (PBC)

The Smart-PLS model with interaction terms to examine the moderation effects of Project Benchmark Characteristics (PBC) is portrayed in Figure 4.

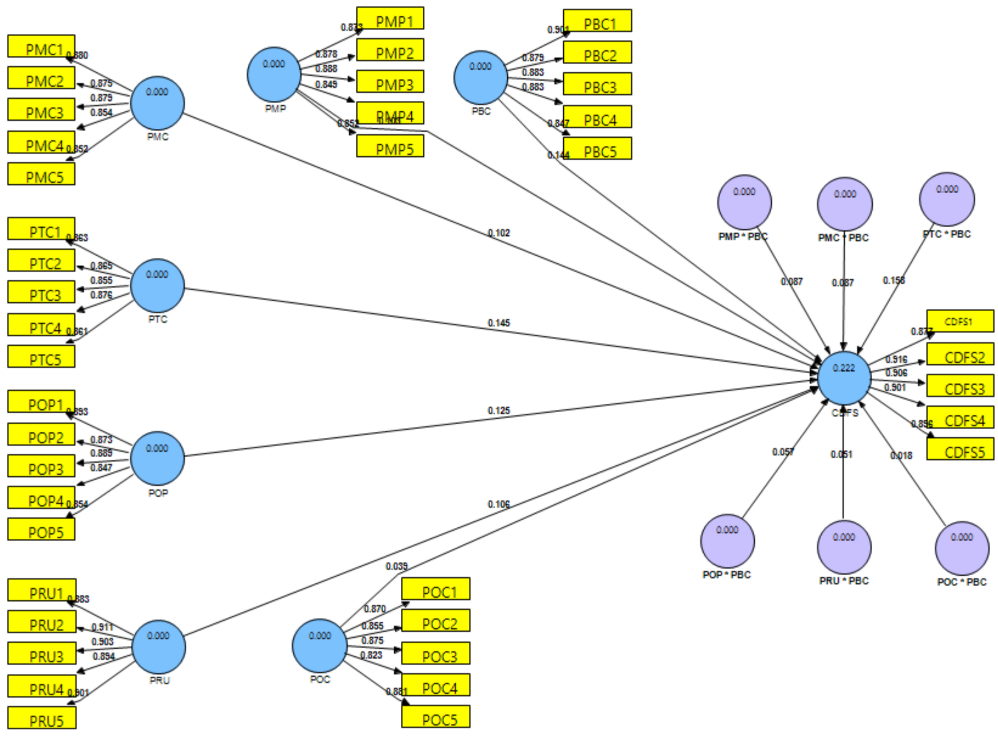

Figure 4. PLS Analysis of the Structural Model for Moderation Effects of Project Benchmark Characteristics (PBC)

The values of R2 for Critical Delay Factor Evaluation (CDFS) was 0.222, above the threshold of 0.1 as recommended by Patterson 2013. The values of Q2 for Critical Delay Factor Evaluation (CDFS) was 0.166, far greater than zero, which refers to predictive relevance of the model as suggested by Chin 2010. In sum, the model exhibits acceptable fit and high predictive relevance.

The moderation (PBC) on the effects of (PMP), (PMC), (PTC), (POP), (PRU) and (POC) as independent variables on Critical Delay Factor Evaluation (CDFS) as dependent variable (DV) were examined as presented in Table 8. Further, the path coefficient was used to evaluate the contribution of each interaction term on the DVs.

Table 8. Moderation Effects of Project Benchmark Characteristics (PBC)

Path Shape	*Path*	Standard Error	T-value	P-value	Hypothesis Result
(PMP*PBC) → CDFS	0.087**	0.025	3.453	0.001	H7a) Supported
(PMC*PBC) → CDFS	0.087***	0.021	4.171	0.000	H7b) Supported
(PTC*PBC) → CDFS	0.158***	0.025	6.412	0.000	H7c) Supported
(POP*PBC) → CDFS	0.057*	0.026	2.224	0.027	H7d) Supported
(PRU*PBC) → CDFS	0.051	0.030	1.669	0.096	H7e) Rejected
(POC*PBC) → CDFS	0.018	0.034	0.521	0.603	H7f) Rejected

*p< 0.05, **p< 0.01, ***p< 0.001

As shown in Table 8, the interaction terms of (PBC) with (PMP), (PMC) and (PTC) and (POP) had significant effects on Critical Delay Factor Evaluation (CDFS) as their p-values were all lower than the standard significance level of 0.05. These results demonstrated that (PBC) moderates the effects of (PMP), (PMC), (PTC) and (POP) on Critical Delay Factor Evaluation (CDFS). Therefore, hypotheses H7a, H7b, H7c and H7d were supported.

Conversely, the interaction terms of (PBC) with (PRU) and (POC) had not any significant effects on Critical Delay Factor Evaluation (CDFS) as their p-values exceeded the standard significance level of 0.05. This result demonstrated that (PBC) could not moderate the effects of (PRU) and (POC) on Critical Delay Factor Evaluation (CDFS). Therefore, hypotheses H7e and H7f were rejected.

7.3 Moderation Effects of Project External Environments (PEE)

The Smart-PLS model with interaction terms to examine the moderation effects of Project External Environments (PEE) is portrayed in Figure 5.

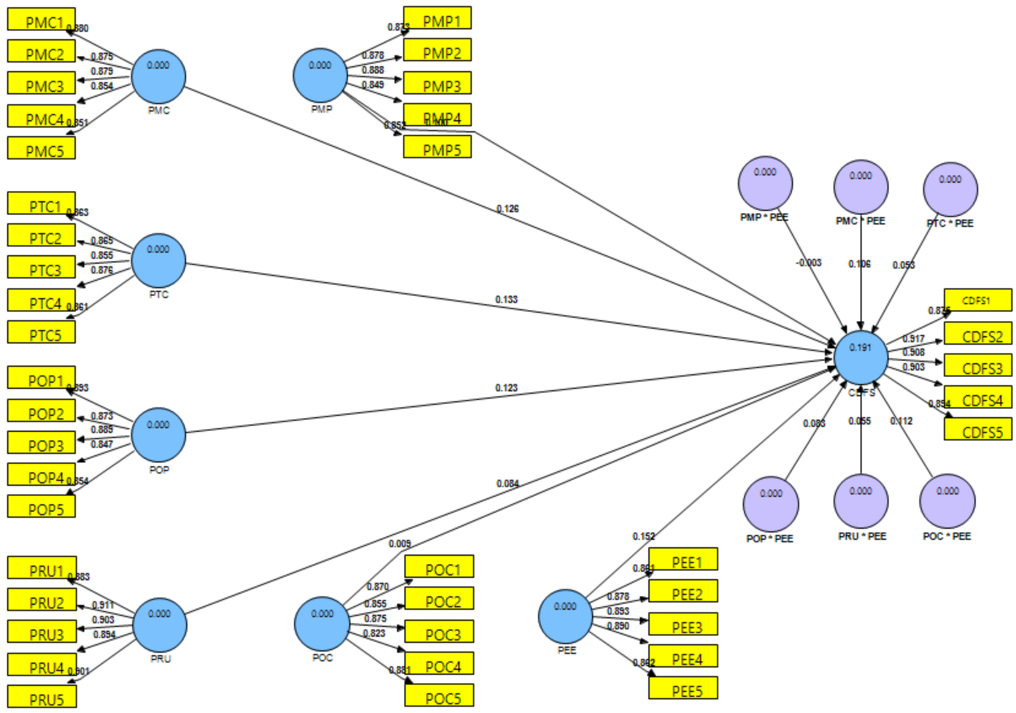

Figure 5. PLS Analysis of the Structural Model for Moderation Effects of Project External Environments (PEE)

The value of R2 for Critical Delay Factor Evaluation (CDFS) was 0.191, above the threshold of 0.1 as recommended by Patterson (2013). The values of Q2 for Critical Delay Factor Evaluation (CDFS) was 0.141, far greater than zero, which refers to predictive relevance of the model as suggested by Chin 2010. In sum, the model exhibits acceptable fit and high predictive relevance. The moderation effects of (PEE) on the effects of (PMP), (PMC), (PTC), (POP), (PRU) and (POC) as independent variables on Critical Delay Factor Evaluation (CDFS) as dependent variable (DV) were examined as presented in Table 9. Further, the path coefficient was used to evaluate the contribution of each interaction term on the DVs.

Table 9. Moderation Effects of Project External Environments (PEE)

Path Shape	*Path* Coefficient	Standard Error	T-value	P-value	Hypothesis Result
(PMP*PEE) → CDFS	-0.003	0.035	0.091	**0.927**	H8a) Rejected
(PMC*PEE) → CDFS	0.106*	0.045	2.375	**0.018**	H8b) Supported
(PTC*PEE) → CDFS	0.053	0.034	1.553	**0.121**	H8c) Rejected
(POP*PEE) → CDFS	0.083**	0.030	2.765	**0.006**	H8d) Supported
(PRU*PEE) → CDFS	0.055*	0.027	2.065	**0.040**	H8e) Supported
(POC*PEE) → CDFS	0.112**	0.035	3.237	**0.001**	H8f) Supported

*p< 0.05, **p< 0.01, ***p< 0.001

As shown in Table 9, the interaction terms of (PEE) with (PMC), (POP), (PRU) and (POC) had significant effects on Critical Delay Factor Evaluation (CDFS) as their p-values were all lower than the standard significance level of 0.05. These results demonstrated that (PEE) moderates the effects of (PMC), (POP), (PRU) and (POC) on Critical Delay Factor Evaluation (CDFS). Therefore, hypotheses H8b, H8d, H8e and H8f were supported.

Conversely, the interaction terms of (PEE) with (PMP) and (PTC) had not any significant effects on Critical Delay Factor Evaluation (CDFS) as their p-values exceeded the standard significance level of 0.05. This result demonstrated that (PEE) could not moderate the effects of (PMP) and (PTC) on Critical Delay Factor Evaluation (CDFS). Therefore, hypotheses H8a and H8c were rejected.

9. Conclusion

Structural model was developed to examine 6 hypothesized direct effects and 12 hypothesized moderation effects of Benchmark Characteristics (PBC) and Project External Environments (PEE). These were done by conducting the path analysis using SMART-PLS 2.0 and testing the significant of the path coefficients for each hypothesized path.

The results indicated that Project Management Process (PMP), Project Manager's Competency (PMC), Project Team's member Competency (PTC), Project Organizational Planning (POP), Project Resources' Utilization (PRU) and Project Organizational Commitment (POC) had significant positive effects on Critical Delay Factor Evaluation (CDFS). The results also indicated that Project Organizational Planning (POP) is the most significant predictor of Critical Delay Factor Evaluation (CDFS), followed by Project Team's member Competency (PTC) and Project Manager's Competency (PMC).

From the results of moderation analysis, it was found that Project Benchmark Characteristics (PBC) positively moderate the effects of Project Management Process (PMP), Project Manager's Competency (PMC) and Project Team's member Competency (PTC) and Project Organizational Planning (POP) on Critical Delay Factor Evaluation (CDFS).

The results also showed that Project External Environments (PEE) positively moderates the effects of Project Manager's Competency (PMC), Project Organizational Planning (POP) and Project Resources' Utilization (PRU) on Critical Delay Factor Evaluation (CDFS). While the effect of Project Organizational Commitment (POC) on Critical Delay Factor Evaluation (CDFS) was inversely moderated by Project External Environments (PEE).

References

Ahsan, K., & Gunawan, I. (2010). Analysis of cost and schedule performance of international development projects. *International Journal of Project Management*, *28*, 68-78. https://doi.org/10.1016/j.ijproman.2009.03.005

Altarawneh, J. Y., Thiruchelvam, V., & Samadi, B. (2017). Determining Critical Success Factors that Contribute to the Delay of Water Infrastructure Construction Projects in the Abu Dhabi Emirate: A Conceptual Framework. *International Business Research*, *10*(12). https://doi.org/10.5539/ibr.v10n12p139

Alzara, M., Jacob, K., Dean, K., & Abdulrahman, A. (2016). Using PIPS to minimize causes of delay in Saudi Arabian construction projects: university case study. *International Conference on Sustainable Design, Engineering and Construction. Procedia Engineering, 145,* 932-939. https://doi.org/10.1016/j.proeng.2016.04.121

Amade, B., Emmanuel, C. U., Enoch, O., Mario, O., & Uchenna, A. P. N. (2015). Critical Success Factors for Public Sector Construction Project Delivery: A Case of Owerri, Imo State. *International Journal of Research in Management, Science & Technology*, *3*(1). Retrieved from www.ijrmst.org

Aziz, R. F., & Abdel-Hakam, A. A. (2016). Exploring delay causes of road construction projects in Egypt. *Alexandria Engineering Journal*, *55,* 1515-1539. https://doi.org/10.1016/j.aej.2016.03.006

Babu, N. J. (2015). Factors Affecting Success of Construction Project. *Journal of Mechanical and Civil Engineering, 12*(2), V, 17-26. https://doi.org/10.9790/1684-12251726

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation model. *Journal of Academy of Marketing Science, 16*(1), 74-94. https://doi.org/10.1007/BF02723327

Banihashemi, S., Hosseini, R., Golizadeh, H., & Shankar, S. (2017). Critical success factors (CSFs) for integration of sustainability into construction project management practices in developing country. *Int. J. Proj. Manag*, *35*(6), 1103-1119. https://doi.org/10.1016/j.ijproman.2017.01.014

Coffman, D. L., & Maccallum, R. C. (2005). Using parcels to convert path analysis models into latent variable models. *Multivariate Behavioral Research, 40*(2), 235-259. https://doi.org/10.1207/s15327906mbr4002_4

Cooper, D. R. (2006). Business research methods. McGraw-Hill Irwin.

Cserháti, G., & Szabó, L. (2014). The relationship between success criteria and success factors in organisational event projects. *International Journal of Project Management, 32,* 613-624. https://doi.org/10.1016/j.ijproman.2013.08.008

Doloi, H., Anil, S., & Iyer, K. C. (2012). Structural equation model for investigating factors affecting delay in Indian construction projects. *Construction Management and Economics*, *30*(10), 869-884. https://doi.org/10.1080/01446193.2012.717705

Durdyev, S., Maksat, O., & Syuhaida, I. (2017). CAUSES OF DELAY IN RESIDENTIAL CONSTRUCTION PROJECTS IN CAMBODIA. *Cogent Engineering, 4*(1). https://doi.org/10.1080/23311916.2017.1291117

Elawi, G. S. A., Mohammed, A., & Dean, K. (2016). Owners' perspective of factors contributing to project delay: case studies of road and bridge projects in Saudi Arabia. *International Conference on Sustainable Design, Engineering and Construction, Procedia Engineering, 145,* 1402-1409. https://doi.org/10.1016/j.proeng.2016.04.176

Gluszak, M., & Lesniak, A. (2015). Construction delays in client's opinion – multivariate statistical analysis. *Procedia Engineering, 123,* 182-189. https://doi.org/10.1016/j.proeng.2015.10.075

Gudienė, N., Audrius, B., Valentinas, P., & Nerija, B. (2014). Identification and evaluation of the critical success factors for construction projects in Lithuania: AHP approach. *Journal of Civil Engineering and Management, 20*(3), 350-359. https://doi.org/10.3846/13923730.2014.914082

Gudienėa, N., Audrius, B., Nerija, B., & Jorge, L. (2013). Development of a Conceptual Critical Success Factors Model for Construction Projects: a Case of Lithuania. *Procedia Engineering, 57,* 392-397. https://doi.org/10.1016/j.proeng.2013.04.051

Gunduz, M., & AbuHassan, M. H. A. (2016). Causes of delay in Qatar construction project. *International Journal of Civil, Environmental, Structural, Construction and Architectural Engineering, 10*(4). Retrieved from http://scholar.waset.org/1307-6892/10004362

Gunduz, M., & Yahya, A. M. A. (2015). Analysis of project success factors in construction industry. *Technological and Economic Development of Economy*. https://doi.org/10.3846/20294913.2015.1074129

Gunduz, M., Nielsen, Y., & Ozdemir, M. (2015). Fuzzy assessment model to estimate the probability of delay in Turkish construction projects. *Journal of Management in Engineering, 31*(4), 04014055. https://doi.org/10.1061/(ASCE)ME.1943-5479.0000261

Hair Joe, F., Christian, M. R., & Marko, S. (2011). PLS-SEM: INDEED A SILVER BULLET. *Journal of Marketing Theory and Practice, 19*(2), 139-151. https://doi.org/10.2753/MTP1069-6679190202

Hair, J. F. (2006). Multivariate data analysis (sixth ed.). United State of America: Pearson prentice hall.

Ho, R. (2006). Handbook of univariate and multivariate data analysis and interpretation with SPSS. United States of America: Chapman & Hall/CRC, Taylor & Francis Group. https://doi.org/10.1201/9781420011111

Hwang, B., Zhao, X., & Ng, S. (2013). Identifying the critical factors affecting schedule performance of public housing projects. *Habitat International Journal, 38,* 214-221. https://doi.org/10.1016/j.habitatint.2012.06.008

Ihuah, P., Tippett, W., & Eaton, D. (2014). A review of critical project management success factors (CPMSF) for sustainable social housing in Nigeria. *International journal of sustainable built environment, 3,* 62-71. https://doi.org/10.1016/j.ijsbe.2014.08.001

Jin, X. H., Tan, H. C., Zuo, J., & Feng, Y. B. (2012). Exploring Critical Success Factors for Developing Infrastructure Projects in Malaysia – Main Contractors' Perspective. *International Journal of Construction Management, 12*(3), 25-41. https://doi.org/10.1080/15623599.2012.10773193

Kazaz, A., Ulubeyli, S., & Tuncbilekli, N. A. (2012). Causes of delays in construction projects in Turkey. *J. Civ. Eng. Manage., 18*(3), 426-435. https://doi.org/10.3846/13923730.2012.698913

Kline, R. B. (2011). Principles and practice of structural equation modeling, 3rd edition. Guilford Press, New York.

Li, H., Arditi, D., & Wang, Z. (2012). Transaction-related issues and construction project performance. *Construction Management and Economics Journal, 30,* 151-164. https://doi.org/10.1080/01446193.2012.655254

Marzouk, M. M., & El-Rasas, T. I. (2014). Analyzing delay causes in Egyptian construction. *Journal of Advanced Research, 5,* 49-55. https://doi.org/10.1016/j.jare.2012.11.005

MOTALEB, O., & KISHK, M. (2013). An investigation into the risk of construction project delays in the UAE. *International Journal of Information Technology Project Management, 4*(3), 50-65. https://doi.org/10.4018/jitpm.2013070104

Mukhtar, M. M., Roslan, B. A., Trevor, S., & Ismail, B. M. (2016). Critical success factors for public housing projects in developing countries: a case study of Nigeria. *Environ Dev Sustain.*

Nafsi, N., Abbas, M. Y., & Nafsi, S. (2015). The Role of Belief and Religion in Creation of Persian Garden. *J. Archit Eng Tech, 4,* 152. https://doi.org/10.4172/2168-9717.1000153

Ng, S., Tang, Z., & Palaneeswaran, E. (2009). Factors contributing to the success of equipment intensive subcontractors in construction. *International Journal of Project Management*, *27*, 736-744. https://doi.org/10.1016/j.ijproman.2008.09.006

Ng, S., Wong, Y., & Wong, J. (2012). Factors influencing the success of PPP at feasibility phase: a tripartite comparison study in Hong Kong. *Journal of Habitat International*, *36*, 423-432. https://doi.org/10.1016/j.habitatint.2012.02.002

Nunnally, J. C., & Bernstein, I. H. (1994). Psychometric Theory, McGraw-Hill, New York.

Obodoh, D. A., & Chikasi, O. (2016). Causes and Effects of Construction Project Delays in Nigerian Construction Industry. *International Journal of Innovative Science, Engineering & Technology*, *3*(5). ISSN 2348-7968.

Park, S. (2009). Whole life performance assessment: critical success factors. *Journal of Construction Engineering*, *135*(11), 1146-1161. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000090

Shebob, N., Dawood, R. K. S., & Xu, Q. (2012). Comparative study of delay factors in Libyan and the UK construction industry. *Engineering, Construction and Architectural Management*, *19*(6), 688-712. https://doi.org/10.1108/09699981211277577

Shehu, Z., Endut, I., Akintoye, A. & Holt, G. (2014). Cost overrun in the Malaysia n construction industry projects: a deeper insight. *International Journal of Project Management*, *32*, 1471-1480. https://doi.org/10.1016/j.ijproman.2014.04.004

Sweis, G. J., Rateb, S., Malek, A. R., Ruba, A. H., & Samer, E. D. (2013). Cost Overruns in Public Construction Projects: The Case of Jordan. *Journal of American Science; 9*(7s), 134-141. (ISSN: 1545-1003). Retrieved from http://www.jofamericanscience.org.

Tabish, S. Z., & Jha, K. N. (2012). Success traits for a construction project. *ASCE Journal of Construction Engineering and Management*, *138*, 1131-1138. https://doi.org/10.1061/(ASCE)CO.1943-7862.0000538

Tan, D., & Ghazali, M. (2011). Critical Success Factors for Malaysian Contractors in International Construction Projects using Analytical Hierarchy Process. *EPPM*, 20-21.

Thi, C. H., & Swierczek, F. W. (2010). Critical success factors in project management: implication from Vietnam. *Asia Pacific Business Review*, *16*(4), 567-589. https://doi.org/10.1080/13602380903322957

Toor, S. U. R., & Ogunlana, S. O. (2009). Construction professionals' perception of critical success factors for large-scale construction projects. *Construction Innovation*, *9*(2) 149-167. https://doi.org/10.1108/14714170910950803

Tumi, S. A. H., Abdelnaser, O., & Abdul, H. K. P. (2009). CAUSES OF DELAY IN CONSTRUCTION INDUSTRY IN LIBYA. *The International Conference on Economics and Administration, Faculty of Administration and Business, University of Bucharest, Romania ICEA – FAA Bucharest*, 14-15th November 2009. Retrieved from http://confernece.faa.ro

Wibowo, A., & Alfen, W. (2014). Identifying macro-environmental critical success factors and key areas for improvement to promote public-private partnerships in infrastructure. *Engineering, Construction and Architectural Management*, *21*(4), 383-402. https://doi.org/10.1108/ECAM-08-2013-0078

Windapo, A., & Cattell, K. (2013). The South African construction industry: perceptions of key challenges facing its performance, development and growth. *Journal of Construction in Developing Countries*, *18*(2), 65-79.

Yang, L., Huang, J., & Wu, K. (2011). The association among project manager's leadership style, teamwork and project success. *International journal of project management*, *29*, 258-267. https://doi.org/10.1016/j.ijproman.2010.03.006

Yong, Y. C., & Mustaffa, N. E. (2013). Critical success factors for Malaysian construction projects: an empirical assessment. *Construction Management and Economics*, *31*(9), 959-978. https://doi.org/10.1080/01446193.2013.828843

Zavadskas, E., Vilutiene, T., Turskis, Z., & Saparauskas, J. (2014). Multi-criteria analysis of Projects' performance in construction. *Journal of Archives of Civil and Mechanical Engineering*, *14*, 114-121. https://doi.org/10.1016/j.acme.2013.07.006

Zawawi, E., Kamaruzzaman, S., Ithnin, Z., & Zulkarnain, S. (2011). A conceptual framework for describing CSF of building maintenance management. University Technology Malaysia. *The 2nd International Building*

Control Conference 2011. Procedia Engineering: Malaysia, 20, 110-117. https://doi.org/10.1016/j.proeng.2011.11.145

Zidane, Y. J. T., Johansenb, A., & Ekambaramb, A. (2015). Project Evaluation Holistic Framework – Application on Megaproject Case. *Conference on Enterprise Information Systems / International Conference on Project Management / Conference on Health and Social Care Information Systems and Technologies, Procedia Computer Science, 64,* 409-416. https://doi.org/10.1016/j.procs.2015.08.532

Zou, W., Kumaraswamy, M., Chung, J., & Wong, J. (2014). Identifying the critical success factors for relationship management in PPP projects. *International Journal of Project Management, 32,* 265-274. https://doi.org/10.1016/j.ijproman.2013.05.004