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Measuring the Effect of the External Factors on Iraqi Construction Projects Performance USING PESTLE Technique

Layth Salman Khalid[1*], Ismail Abdul Rahman[2]

[1]*Faculty of civil and Environmental Engineering, University tun Hussein onn Malaysia (UTHM),*
[1*]*layth.s.khalid@gmail.com*, [2]*ismailar@uthm.edu.my*

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Abstract
The efficiency of construction industry is positively contributing to cost saving, growth and economy improvement of all countries round the world. However, construction projects execution suffers from several restrictions and risks that affect projects progression operations, which commonly have a substantial negative effect on overall projects performance. Previous researches measured the effect of internal factors related to company or project specific on project performance and ignored the external factors. This research seeks to fill this gap by using the PESTLE technique to measure the effect of the external factors on Iraq construction industry performance in terms of time, cost, and quality. The research data is collected by a survey questionnaire with several construction project practitioners in Iraq. The PLS-SEM is used to analyze the data and develop the measurement model. The results reveal that the model fits the nature of the data and the research variables. Investigating the effect of these factors will help construction industries to prevent or mitigate risks, control expenditures, and achieve competitive advantages.

Keywords*: Measurement model; Construction project; Project performance, PESTLE*

1. INTRODUCTION

Construction industry plays a key role in nation's development. It contributes significantly to countries growth and economy of nations, where construction projects account around 10% of gross domestic product (GDP) of many developed and developing countries (Kathomi, 2016; Bello, 2018; Okoye et al., 2018). Thus, enhancing the construction sector efficiency is certainly contributing to cost saving and economy growth of countries. Many factors are used to evaluate project performance such as time, cost, quality, client satisfaction, safety and health business performance (Bello, 2018). However, cost, time, quality are key factors in accomplishing a construction project success (Auma, 2014; Abd El-Karim et al., 2015). Completing a project in time, within specific budget according to certain specifications is an indicator of a success project (Durdyev et al., 2018). Yet, a construction project execution is exposed to various restrictions and risks that limit its progress, consequently affect its performance (Alinaitwe et al., 2013; Soewin and Chinda, 2018). As the construction industry works in a particularly project-specific and multifaceted environment including various parties, consulting professions, and contractual arrangements, it faces various challenges affecting its performance and development

(Sibiya et al., 2014). Generally, the factors that affect project performance are attributed to project specific, parties, and to external environment such as economic, political and environmental changes (Sorooshian, 2014; Rastogi and Trivedi, 2016). According to Omran et al. (2012), project environment comprises all the external factors influencing the construction performance such as political, social and technical system. Evaluating these factors is vital to develop the necessary strategies to prevent their effects on projects performance and success (Ansah et al., 2016). However, most researches only investigate the internal factors related to company specific or project specific (Rastogi and Trivedi, 2016), and ignored the external factors.

2. BACKGROUND

Shaban (2008) and Omran et al. (2012) stated that accomplishing construction project effectively needs to consider business environment, political stability and economic with managerial quality, fiscal, technical and managerial performance. Rastogi and Trivedi (2016) indicated that external factors cannot be controlled by organizations and they are difficult to be identified. Helen et al. (2015) confirmed that the construction projects performance is influenced extremely by the external factors such as political, economic, social, and cultural. On the other hand, Pulaj and Kume (2013) clarified that business strategies and managerial processes should consider the external environment due to their uncertainty and dynamics increase that need thorough analysis of the macro-environment using the PESTLE technique (De la Hoz-Rosales, Camacho and Tamayo, 2019). Ansah et al. (2016) indicated that the key external challenges are categorized into essential groups called "PESTLE" factors. This technique is a strategic management technique utilized efficiently in the external factors recognition process. PESTLE refers to political (P); economic (E); social (S); technological (T); legal (L) and environmental (E). External factors are unforeseeable and may cause effects that cannot be simply handled or avoided without substantial losses; therefore, there is a necessity to study their influences on the performance of construction projects. Understanding these influences is significant for construction industry to control expenditures, manage risks and achieve competitive advantages (Eddelani, El Idrissi and Monni, 2019). This research considers Iraq as a case study due to the critical situation Iraq passing through especially political and economic difficulties that affect all aspects particularly after the American invasion in 2003 (Bekr, 2017). Some studies conducted in Iraq have investigated several influential factors on construction projects (Jaber, 2015; Abdulsattar, 2017) regardless studying the external factors separately despite their importance due to political, economic and social situation deterioration. This paper aims to investigate the effect of the external factors on Iraqi construction project performance in terms of time, cost, and quality using PESTLE techniques. This technique is utilized because it is a comprehensive framework and an effective tool to recognize, investigate, and categorize the various variables in the macro environment (Ansah et al., 2016).

3. RESEARCH MODEL AND HYPOTHESES

Researchers developed several models on the factors affecting the project construction performance in terms of time, cost, and quality. They mostly investigated the internal factors related to project and its participants. Alias et al. (2014) in his model studied the effect of external factors among other factors on business project performance. They include political, economic, social, and technology issues. Niagara and Datche (2015) studied the effect of economic, social and technology among others on the construction project performance in coastal region of Kenya. Alfakhri et al. (2017) developed a model to study several factors affecting construction project in Libya. Among these factors are the external factors, which include weather changes, political, economic, unstable situations. Durdyev et al. (2018) studied the effect of social, environmental and technological factors among several factors on construction projects in Cambodia. Soewin and Chinda (2018) studied the effect of environmental and technological factors among others on construction project performance. Alashwal et al. (2017) studied the effect of political, economic, social and technological factors among others on the international construction projects in Malaysia. It can be seen from the previous research that they considered the effect of several factors including some external factors. Therefore, this research contributes to the literature in investigating the effect of most external factors on project performance using PESTLE technique. The effect of these factors on project performance is studied in terms of cost, time, and quality since they are the most frequent indicators utilized by most all researchers. Thus, a conceptual model is developed to define the effect of PESTLE factors on the performance of the construction project. The independent variables of this research are six factors (PESTLE factors), while the dependent variable is the project performance. Time, cost, and quality factors are included in the conceptual model to investigate how they contribute to project performance since the literature indicates that they are the main indicators of performance. Based on the developed conceptual model, six hypotheses are developed to investigate the effect of PESTLE factors on the performance. The following figure illustrates the model of this research.

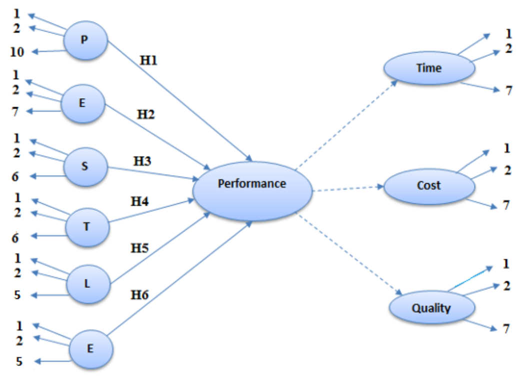

Figure 1: Research conceptual Model

Based on the research model, six hypotheses are developed:

H1: Political factor has a significant effect on project performance

H2: Economic factor has a significant effect on project performance

H3: Social factor has a significant effect on project performance

H4: Technological factor has a significant effect on project performance

H5: Legal has a significant effect on project significant effects on project performance

H6: Environmental has a significant effect on project significant effects on project performance

The model includes PESTLE factors with 39 items, and the time, cost and quality factors which include 21 items. The constructs and their items are introduced in Table 1.

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Table 1: Items of PESTLE Constructs

No.	Political (PL)	Economic (EC)	Social (SC)	Technological (TC)	Legal (LG)	Environment (EN)
1	Bureaucracy	Currency Fluctuation / Exchange Rate	Low Tendency to Teamwork	Information Technology Unavailability	Comply with Environmental Protection Laws and Regulations	Project Impact on Environment (waste, Dust)
2	Hostile Political Environment	Prices Inflation	Poor Relationship Among Project Participants	Material/Equipment Specification Un-clarity and Inadequacy	Contract Breach By Project Parties	Weather and Climatic Condition Impact
3	Late Government Funding	Employees Training Costs	Health and Safety Measures at Work	Unavailability of Technology and expertise	Contract Documents Improper Verification	Construction Waste Handling Problem
4	Insufficient Government Funding	Site Security Cost	Hostile Social Environment	Technology Solve The Problem of Design Complexity	Lack of Enforcing Legal Judgment	Effect of Location and Site Conditions
5	Embezzlement and Bribery	Hostile Economic Environment	Un-official Holidays	Technology Reduces Project Time and Cost	Conformance to Regulations and Legislations (safety , health, insurance)	Health and Safety Issues (Pollution, Uncontrolled Sanitation, Release of Non-Biodegradable Material)
6	Changes of Government Policies	Financial Appraisals	Problems due to Adjacent or Nearby Projects	Technology Enhances Quality and Safety		
7	Political Changes	Cost Variances				
8	Security Measures					
9	Regulations and Legislations Change					
10	Political Interference					

4. RESEARCH METHODOLOGY

To test the proposed research model validity, data is collected by a structured questionnaire with various project parties in several organizations in public sector in construction industry in Iraq. The actual survey questionnaire is the outcome of a reliability test and a validation process. The reliability test includes a pilot study with 30 respondents from construction projects of Iraq, while the validation includes an expert judgement with 12 experts from construction sector in Iraq and Malaysia. The actual questionnaire includes three sections for demographic factors, effects of PESTLE on project performance and effects of time, cost and quality on project performance respectively. The target respondents for this survey are different construction project parties such as contractors, sub-contractors, consultants, project manager, and civil engineers who are selected based on a simple random sampling technique. The sample size is selected based on Hair et al. (2016), where they equal to 10 times the largest number of formative indicators used to measure a single construct. The size should be 100, but totally 140 questionnaires are distributed to avoid the shortage in the questionnaires due to various reasons (missing, ignoring, incomplete). The respondents asked to rate all the items of the research variables according to the 5-point Likert scale. The questionnaire data is analyzed using PLS-SEM package using several statistical analyses such as descriptive analysis and multivariate analysis to develop the measurement model of the influencing PESTLE factors.

5. RESULTS AND DISCUSSIONS

5.1 Questionnaire Validity and Reliability

The experts' panel suggested many modifications such as modifying the questionnaire structure, changing few items of the dimensions, the style, in addition to modify some of the personal information of the respondents. The pilot study is used to test the reliability of the research questionnaire using Cronbach alpha. According to Hair et al. (2016) values of 0.60 to 0.70 are considered as lower acceptable limits in exploratory research. The Cronbach alpha values of the constructs are shown in the Table 2.

Table 2: Reliability Test of Pilot Study

No.	Construct	Items Number	Cronbach Value
1	Political	10	0.836
2	Economic	7	0.813
3	Social	6	0.782
4	Technological	6	0.843
5	Legal	5	0.762
6	Environment	5	0.780
7	Time	7	0.801
8	Cost	7	0.726
9	Quality	7	0.794
Total		60	
Valid Questionnaires = 30			

Table 2 indicates that coefficient alpha values of all items are more than 0.7. This reflects the high internal consistency and reliability of all constructs to be utilized in the final survey questionnaire.

5.2 Actual Survey

Total of 140 questionnaires are distributed, and the collected are 132, while the valid responses are 127. The respondents' demographic characteristics are introduced in the following Table.

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Table 3: Respondents Demographic Characteristics

	Characteristics	Frequency	Percent
Educational Qualification	Diploma	7	5.5%
	BSc	85	66.9%
	MSc	21	16.5%
	PhD	14	11%
	Total	127	100%
Designation	Project Manager	45	35.4%
	Engineer	52	40.9%
	Consultant	26	20.5%
	Contractor	2	1.6%
	Sub-Contractor	2	1.6%
	Total	127	100%
Working Experience	1-3 years	1	0.8%
	3-5 years	13	10.2%
	5-7 years	12	9.4%
	7-10 years	16	12.6%
	> 10 years	85	66.9%
	Total	127	100%

1. Reliability Test

The reliability test aims to ensure the consistency and stability of the questionnaire. Cronbach alpha is used for this purpose as shown in Table 4.

Table 4: Reliability Test of Actual Survey

No	Construct	Code	Items Number	Alpha Value
1	Political	PL	10	0.896
2	Economic	EC	7	0.861
3	Social	SC	6	0.895
4	Technological	TC	6	0.893
5	Legal	LG	5	0.834
6	Environment	EN	5	0.828
7	Time	TM	7	0.814
8	Cost	CT	7	0.808
9	Quality	QL	7	0.815

It can be seen from Table 4 that all constructs attain high Cronbach alpha values more than 0.7, which means that there is a high internal stability degree of all constructs. This means that we can rely on these constructs in achieving the research objectives and in results analysis.

1. Descriptive Statistics

Descriptive statistics describe characteristics of a detailed data by introducing a summary about the sample and data measures. The common descriptive statistics are the mean and standard deviation**,** which are introduced in Table 5.

Table 5: Descriptive Statistics

No.	Construct	Code	Mean	Standard Deviation
1	Political	PL	3.61	1.16
2	Economic	EC	3.12	1.30
3	Social	SC	4.03	0.83
4	Technological	TC	4.15	0.88
5	Legal	LG	3.7	1.14
6	Environment	EN	3.67	1.23
7	Time	TM	3.19	0.59
8	Cost	CT	2.95	0.57
9	Quality	QL	3.53	0.58

Table 5 shows that the mean score for all items ranges from 2 to 4.5. The standard deviation of all items ranges between 0.57 and 1.25, which indicates that data are consistent and convergent and confirm the relationship of the mean to the rest of the data.

5.3 Measurement Model

The measurement model shows the relationships between the research constructs and their items. The measurement model constructs should be measured for validity to develop the structural model. Convergent validity and discriminant validity are used to test the constructs validity.

1. Convergent Validity

Constructs convergent validity can be evaluated using the outer loadings of the items, the average variance extracted (AVE), composite reliability (CR) and Cronbach alpha for evaluating internal consistency (Hec, 2105). The standardized outer loadings should be greater than 0.7. The AVE is the average of items loading of a construct and its value should be 0.5 or higher, CR should exceed 0.7 (Hair, 2016). Total of 11 items with weak factor loading (less than 0.5) are deleted from all constructs. The deleted items are (PL7, PL9, PL10, EC4, SC4, TC2, LG5, EN1, TM2, CT7, QL1). The CR values are more than the acceptable value (0.7). All the AVE values are greater than 0.50, which indicates that the all constructs explain more than half of the variance of their items (Hair, 2016).

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2. Discriminant Validity

Discriminant validity is the degree to which latent variable discriminates from other latent variables (Farrell 2010). To assess discriminant validity of the reflective measurement model, the Fornell-Larcker criteria, cross loadings are implemented. The Fornell-Larcker assesses the cross validity on the construct level, while the cross loading on the items level.

Table 6: Discriminant Validity Using Fornell-Larcker

	CT	EC	EN	LG	PL	QL	SC	TC	TM
CT	**0.717**								
EC	-0.536	**0.777**							
EN	-0.545	0.511	**0.813**						
LG	-0.205	-0.089	0.085	**0.816**					
PL	-0.284	0.219	0.148	0.039	**0.785**				
QL	0.592	-0.493	-0.525	-0.381	-0.203	**0.724**			
SC	-0.474	0.432	0.46	-0.026	0.154	-0.363	**0.839**		
TC	0.494	-0.38	-0.455	-0.049	-0.123	0.478	-0.355	**0.837**	
TM	0.618	-0.629	-0.411	0.082	-0.299	0.607	-0.505	0.507	**0.728**

Fornell-Larcker compares the AVE square root values with the latent variable correlations. Each construct's AVE square root must be bigger than its highest correlation with any other construct (Hair, 2016). Table 6 shows that the AVS square root of each construct is bigger than its correlation with other constructs. This indicates that all the constructs are discriminant and each construct shares more variance with its items than with any other construct.

Table 7: Discriminant Validity Using Cross-Loadings

Item	Economic	Environment	Legal	Political	Social	Technological	Time	Cost	Quality
EC1	**0.73**	0.33	-0.05	0.09	0.33	-0.24	-0.43	-0.44	-0.29
EC2	**0.83**	0.39	-0.15	0.22	0.40	-0.36	-0.53	-0.42	-0.43
EC3	**0.84**	0.44	0.02	0.22	0.35	-0.30	-0.50	-0.44	-0.48
EC5	**0.80**	0.42	-0.07	0.19	0.34	-0.27	-0.50	-0.45	-0.38
EC6	**0.77**	0.38	-0.06	0.17	0.38	-0.29	-0.50	-0.43	-0.39
EC7	**0.69**	0.41	-0.11	0.11	0.21	-0.31	-0.48	-0.31	-0.31
EN2	0.34	**0.75**	0.03	0.08	0.27	-0.40	-0.31	-0.34	-0.40
EN3	0.43	**0.86**	0.12	0.11	0.45	-0.42	-0.31	-0.47	-0.45
EN4	0.43	**0.81**	0.03	0.20	0.46	-0.27	-0.36	-0.44	-0.42
EN5	0.46	**0.83**	0.08	0.10	0.32	-0.40	-0.35	-0.50	-0.43
LG1	-0.09	0.06	**0.81**	0.08	0.03	-0.01	0.08	-0.17	-0.31
LG2	-0.12	0.05	**0.85**	0.01	0.00	-0.05	0.03	-0.19	-0.36
LG3	-0.03	0.10	**0.84**	0.06	-0.03	-0.04	0.07	-0.20	-0.31
LG4	-0.05	0.06	**0.76**	-0.03	-0.10	-0.07	0.10	-0.08	-0.25
PL1	0.24	0.09	-0.08	**0.78**	0.19	-0.02	-0.28	-0.17	-0.15
PL2	0.13	0.01	-0.07	**0.67**	0.04	-0.04	-0.12	-0.14	-0.11
PL3	0.18	0.19	-0.01	**0.81**	0.09	-0.14	-0.31	-0.25	-0.22
PL4	0.14	0.08	0.09	**0.74**	0.09	-0.08	-0.20	-0.20	-0.12
PL5	0.16	0.11	0.10	**0.84**	0.19	-0.15	-0.23	-0.27	-0.17
PL6	0.17	0.14	0.06	**0.82**	0.12	-0.15	-0.25	-0.29	-0.17
PL8	0.18	0.13	0.10	**0.83**	0.10	-0.07	-0.21	-0.20	-0.15
SC1	0.34	0.41	0.00	0.04	**0.74**	-0.24	-0.31	-0.32	-0.24
SC2	0.40	0.40	0.03	0.20	**0.84**	-0.35	-0.50	-0.42	-0.40
SC3	0.45	0.39	-0.05	0.18	**0.91**	-0.36	-0.51	-0.49	-0.32
SC5	0.26	0.28	-0.02	0.07	**0.85**	-0.15	-0.29	-0.28	-0.16
SC6	0.31	0.43	-0.06	0.10	**0.86**	-0.32	-0.42	-0.42	-0.33
TC1	-0.31	-0.36	0.02	-0.02	-0.27	**0.83**	0.44	0.31	0.37
TC3	-0.28	-0.26	0.00	-0.13	-0.26	**0.82**	0.47	0.40	0.34
TC4	-0.32	-0.44	-0.07	-0.14	-0.33	**0.89**	0.43	0.49	0.47
TC5	-0.36	-0.46	-0.03	-0.12	-0.39	**0.86**	0.44	0.43	0.41
TC6	-0.31	-0.38	-0.12	-0.11	-0.23	**0.79**	0.35	0.43	0.40
TM1	-0.50	-0.34	0.01	-0.35	-0.29	0.36	**0.80**	0.49	0.61
TM3	-0.23	-0.14	0.15	-0.21	-0.29	0.27	**0.50**	0.31	0.06
TM4	-0.58	-0.36	-0.04	-0.30	-0.38	0.37	**0.83**	0.49	0.69
TM5	-0.26	-0.21	0.05	-0.09	-0.38	0.25	**0.57**	0.30	0.19
TM6	-0.48	-0.33	0.10	-0.28	-0.34	0.49	**0.85**	0.53	0.54
TM7	-0.57	-0.34	0.13	-0.08	-0.53	0.42	**0.74**	0.51	0.37
CT1	-0.26	-0.16	-0.19	-0.18	-0.25	0.23	0.29	**0.58**	0.11
CT2	-0.45	-0.40	-0.16	-0.26	-0.42	0.34	0.58	**0.79**	0.53
CT3	-0.26	-0.45	-0.19	-0.14	-0.33	0.33	0.21	**0.63**	0.26
CT4	-0.39	-0.45	-0.24	-0.30	-0.34	0.31	0.45	**0.80**	0.50
CT5	-0.39	-0.40	-0.15	-0.28	-0.31	0.46	0.57	**0.77**	0.56
CT6	-0.52	-0.44	0.01	-0.06	-0.38	0.43	0.50	**0.71**	0.47
QL2	-0.46	-0.49	-0.27	-0.25	-0.34	0.38	0.55	0.45	**0.84**
QL3	-0.31	-0.42	-0.41	-0.21	-0.21	0.29	0.39	0.50	**0.70**
QL4	-0.13	-0.27	-0.29	-0.09	-0.24	0.41	0.27	0.31	**0.59**
QL5	-0.39	-0.34	-0.23	-0.13	-0.22	0.38	0.42	0.43	**0.77**
QL6	-0.33	-0.39	-0.24	-0.05	-0.21	0.36	0.39	0.43	**0.70**
QL7	-0.48	-0.35	-0.22	-0.13	-0.35	0.28	0.58	0.43	**0.74**

The cross loading assesses the cross validity on the items level. The discriminant validity using cross-loadings are introduced in Table 7. The results of the cross loadings indicate that the highest items outer loadings under its related construct are higher than all its cross-loadings (correlation) with other constructs. This indicates that the model has accomplished its discriminant validity, where all PESTLE factors have no correlation with each other, and they are different from each other. That means that each PESTLE construct is unique and includes issues not represented by other constructs in the model. This is an indicator that the items of each construct are measuring it and not correlated with other construct items.

6. CONCLUSIONS

The measurement model defines the relations between observed and latent (unobserved) variables and describes the observed variables measurement properties. This model postulates

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hypotheses on the relations between the observed variables and the latent variables they were designed to measure. The observed variables are the constructs items, while the latent variables are the constructs. The measurement model is important as it provides a test for the reliability of the observed variables employed to measure the latent variables. The convergent validity led to delete 11 items from the different constructs. The discriminant validity tests showed that all the constructs are discriminant and each construct shares more variance with its items than with any other construct.

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