

ASSESSING THE FACTORS CAUSING PROJECT COMPLETION DELAYS IN THE CONSTRUCTION SECTOR OF OMAN USING SEM-PLS

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Abstract

Purpose: The objectives of the study were to investigate the causes of the delays to analyze the factors causing the construction delay in Oman and to investigate the effects of such delays.

Design/methodology/approach: To carry out this study 210 samples were collected through a well-defined questionnaire from the construction stakeholders viz. the consultants, contractors, and the clients who were selected on a random sampling basis. Smart PLS for Structural Equation Modeling (SEM) technique was used to analyze the data to obtain the formative measurement models, the structured model, and the goodness of fit.

Findings: The results of the study reveal that the client-related factors, equipment-related factors, and material related factors have a significant impact on the completion delay in construction projects. The findings of the study also revealed that the Client related factors were – Delay in providing services, Delayed decision-making process, Allocation of insufficient time. Equipment related factors were – Existing low productive equipment, Unskillful Equipment operator, Breakdown of equipment and Outdated equipment; Material related factors were – Delay in supply of raw materials, Non-availability of materials, Change of materials during construction, Non-availability of accessories and Damaged materials.

Research limitations/Implications: The present study covers the stakeholders of the construction projects from selected regions only. The future studies can be extended to other projects and other regions as well.

Social implications: The study suggested that the clients' cooperation especially in providing the contractors with the necessary equipment, facilities, and sufficient time will avoid such delays of the construction projects in Oman.

Originality/Value: Only very few have examined the completion delay of the construction projects in Oman using SEM-PLS and it is a first-hand study of its kind and the results will be useful to the stakeholders.

Keywords: Factors Causing a Delay in Construction Projects, Client Related Factors, Contractor Related Factors, Equipment Related Factors, Labor-related Factors, Time Lag in Construction Projects, Project Conflicts, Impact of Delay in Construction Projects.

INTRODUCTION

Oman continues to realize the aims of its ninth five-year development plan – 2016 to 2020 plan focuses on the sectors with growth potentials. The construction sector is one of the major sectors in Oman with more growth potentials (<u>Ali, Nusair</u>, <u>Alani, Khan, & Al Badi, 2017</u>) and the rise in the construction projects market since 2016 largely attributes to the Government's economic diversification efforts (<u>Malik & Mitchell, 2018</u>). Since 2007, the construction projects in Oman are getting delayed in completion for various reasons such as improper planning and scheduling, poor construction, changes in designs, variation and claims thereby, and material shortage (<u>Alnuaimi & Mohsin, 2013</u>).

Construction delays occur when the actual progress is slower than the planned / contract schedule (<u>Hari & Pandey, 2016</u>). Delay / the time lag in the completion of construction projects is a critical issue affecting the construction industry and is an alarming issue over the globe. There are various occurrences in which delays are caused by more than one factor. Sometimes one delay leads to the other as well. For example, the massive delays in construction projects related to airport works endanger investments in Oman. The transport and logistics sector very much depends on their completion (<u>Shaibany, 2015</u>). Delays in such completion put on hold millions of Rials of other investments. In complex projects involving different types of activities, delays are analyzed based on two major parameters, i.e., time and cost. Indeed, the impact level of the delay differs from project to project. Delays can adversely affect the stakeholders, end up with zero incentives or negative productivity or termination of contract agreements or litigations.

It is becoming unusual that a project work gets over within the stipulated period. According to Ogweno, Muturi, and Rambo (2016), successful completion of a construction project in time, considered to be a sign of project efficiency. The successful accomplishment of a project is measured basically by the time spent, the total cost involved and the quality of work done. The construction delay affects the timely completion, cost, and quality. Proper decision making well ahead of starting a



project, approving designs and working drawings, material selections, and logistics planning may reduce the future problems arising during the construction stage.

RATIONALE BEHIND THE STUDY

Understanding the causes of construction delays might help the stakeholders to minimize the effect so as to preplan to overcome the impact of such delays. The construction process depends on several factors occurring from various sources. The factors causing the delay in the construction sector involve unanticipated factors, external factors, and the factors involving contractors and clients (<u>Alsendi, 2015</u>). These factors cause a delay in a project and may give rise to conflicts and/or claims. Such delay claims are complicated and end up in high cost unless there is a concurrence on the project extension time to avoid litigation (<u>Yusuwan & Adnan, 2013</u>). <u>Saeed (2009</u>) pointed out that most of the time, the delay of the projects leads to failure of the projects and most of the time the objectives of the projects are not fully accomplished. Further, the failure will be across the key performance measures viz. cost, time and quality. i.e. if the causes of the construction completion delays are identified the resulting loss can be minimized.

The increasing delays in the construction projects are affecting the national economy of Oman as it results in wastage of resources, increased costs of projects, and dissatisfaction among the clients. Thus, it becomes important for the project managers to complete the projects within the budgeted cost and time. As Oil and Gas (O&G) construction projects are a major arena that could directly affect the economic growth of Oman, it becomes essential to pay more attention to find out the causes. Thus the purpose of the study was to analyze the causes for such delays, to analyze the factors causing the construction delay in Oman and to investigate the effects of such delays.

REVIEW OF LITERATURE

Improper – planning, designing, construction, and finishing are the causes for the construction time overrun in Oman (<u>Al</u> <u>Saadi, Latif, & Al-Nuaimi, 2018</u>). Time delays are the major challenges for the construction sector (<u>Pourrostam, Ismail, & Mansournejad, 2011</u>) and delays can severely affect the project stakeholders (<u>Al-Khalil & Al-Ghafly, 1999</u>). The delay causes a hike in costs, loss of productivity, and revenue resulting in termination of the contract sometimes (<u>Kraiem & Diekmann, 1987</u>). <u>Kaming, Olomolaiye, Holt, and Harris (1997</u>) stated that cost overruns are more than time overrun and that cost overruns are caused by material price variation and price assessment errors.

<u>Odeyinka and Yusif (1997</u>) stated that the delay occurs mainly during the construction phase which originates from the design phase due to inadequate schedule control, untimely review of designing, non-introduction of latest technologies into the designs. Poor project formulation at the initial stage and hesitancy to take timely decisions are the factors causing delays (<u>Iver & Jha, 2005</u>). Improper calculation of project duration, inconsistencies with the contracts, specifications, and understanding are the factors causing delays in the construction completion (<u>Olawale & Sun, 2010</u>). The causes of the delays might be due to unrealistic deadlines and cultural influences (<u>Ren, Atout, & Jones, 2008</u>). <u>Sambasivan and Soon (2007</u>) identified that the maximum causes for the delays arise from the contractor's side. However, the shortage of materials and equipment, and inadequate labor supply causes a delay for the contractor from completing his project. Failure to supervise the contractors' work leads to delay in the project (<u>Acharya, Lee, Kim, Lee, & Kim, 2006</u>). <u>Odeh and Battaineh (2002</u>) confirmed that the main cause for the contractors get affected largely due to completion delays and as a consequence, their revenue declined. <u>Sweis, Sweis, Hammad, and Shboul (2008</u>) stated that most of the delays arise due to poor management; and natural calamities add fuel to it.

<u>Umar (2018)</u> revealed that the contractual issues, workforce problems, unavailability of materials, and non-coordination between the parties were the factors causing delay to construction projects in Oman. <u>Shaibany (2015)</u> stated that the delays are mostly due to material shortages, delays in payments, equipment failures and frequent project variations. The effects of variations in construction projects in Oman were the delayed completion date, cost overruns; additional costs incurred by contractors due to variations, and disputes (<u>A1 Harthi, 2005</u>).

Latif, Al Saadi, and Rahman (2019) identified that changes in project scope, lack of communication between the parties, shortage of labor, construction mistakes, and lack of design were the causes for the delay in completion. Emam, Farrell, and Abdelaal (2015) confirmed that the factors causing a delay in construction projects' completion were the delayed response from utility agencies, major design changes during construction, ineffective planning and scheduling, inefficient control of progress, and changes in the scope of the project. Chan and Kumaraswamy (1997) found that the factors creating delays were unanticipated field conditions, variations, inefficient site management, and poor decision making. Assaf and Al-Hejji (2006) pointed out that the most probable cause for the delay is due to change orders. Sacks and Goldin (2007) explained that the changes in the project lead to delay, an increase in the cost of the project and ends in complications. Faridi and El-Sayegh (2006) confirmed that the delay in the preparation and approval of drawings, specifications and documents, and changes in drawings are the major factors causing delays from the consultant side. Assaf, Al-Khalil, and Al-Hazmi (1995) pinpointed



out that the drawings and the design amendments are the factors which trigger delays and break the smooth relationship between the supplier and the project. <u>Al-Momani (2000)</u> identified the main causes of delay as poor design and change orders, and attention needs to be paid to minimize the disputes arising thereby avoiding the resulting failures.

<u>Al Mohsin and Alnuaimi (2013)</u> claimed that the client related causes were the prime reason for any construction delay in Oman. <u>Alnuaimi and Mohsin (2013)</u> confirmed that the client is the main cause for the delay of the construction projects in Oman and the issue could be resolved easily only if the owners of the project follow up on the projects at all stages. <u>Alnuaimi, Taha, Al Mohsin, and Al-Harthi (2010)</u> studied the change orders determined that the additional works and design modifications caused delays, disputes, and cost overruns.

<u>Divakar and Subramanian (2009)</u> came out with a program for computing activity delays leading to project delays. <u>Toor and</u> <u>Ogunlana (2008)</u> constructed a decision support system to analyze construction delays concluded that the major factors as equipment, material, labor, management, client, subcontractors, and weather.

<u>Le-Hoai, Dai Lee, and Lee (2008)</u> identified the critical factors causing a delay are a sluggishness, incompetence, design, estimation, finance, government, and workers. <u>Nkado (1995)</u> claimed that the project implementation delay causes a delay in architectural fields. According to <u>Kadir, Lee, Jaafar, Sapuan, and Ali (2005)</u>, the primary factors causing delay were the shortage of materials, delayed payments, change orders, late submission of drawings, inadequate labor supply, and poor site management.

<u>Gündüz, Nielsen, and Özdemir (2013)</u> found that insufficiency of labor, poor site management, improper project planning, and time lag of materials supply are the lead causes for the delays from the contractor side. <u>Ling and Hoi (2006)</u> found out the technical causative factors for the delays were design failures, estimation errors, and failure of new technology adoption. All the above-referred factors have been taken into consideration in our study questionnaire.

HYPOTHESES

From the above literature review, 54 items have been identified and they were grouped under five variables viz. client-related factors, contractors related factors, equipment-related factors, labor-related factors, and material related factors were taken into consideration and thus the following hypotheses were framed viz.

- 1. Client-related factors influence the effects of Project Completion delay.
- 2. Contractors related factors influence the effects of Project Completion delay.
- 3. Equipment-related factors influence the effects of Project Completion delay.
- 4. Labor-related factors influence the effects of Project Completion delay.
- 5. Materials related factors influence the effects of Project Completion delay.

RESEARCH METHODOLOGY

To carry out this study 210 samples were collected through a well-defined questionnaire from the construction stakeholders viz. the consultants, contractors, and the clients who were selected on a random sampling basis. Smart PLS for Structural Equation Modeling (SEM) technique was used to analyze the data to obtain the formative measurement models, the structured model, and the goodness of fit.

FINDINGS

Demographic details of the respondents are given in Table 1.

Characteristics		Frequency	%	
Nationality	Omani	123	58.6	
	Non-Omani	87	41.4	
Gender	Male	133	63.3	
	Female	77	36.7	
Age	20-30 years	59	28.1	
	30-40 years	61	29.0	
	40-50 years	44	21.0	
	50-60 years	23	11.0	
	60 years and above	23	11.0	
Projects involved	Construction Project	19	9.0	

 Table 1: Demographic details of the respondents



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	Industrial Project	20	9.5
	Planning Engg. Project	27	12.9
	Infrastructure Project	56	26.7
	Utility Project	16	7.6
	Petrochemical Project	18	8.6
	Building Project	46	21.9
	Other Projects	8	3.8
Department	Oil and Gas	87	41.4
	Steam	29	13.8
	Electrical	61	29.0
	Others	33	15.7
Years of Experience	< 10 years	95	45.2
	10 – 20 years	54	25.7
	20 – 30 years	44	21.0
	> 30 years	17	8.1
Status	Contractors	55	26.2
	Clients	67	31.9
	Suppliers	58	27.6
	Consultants	30	14.3
Location of the project	Fahoud	26	12.4
	Yibal	24	11.4
	Marmol	35	16.7
	Alkuwair	29	13.8
	Qurn Al Alam	15	7.1
	Sohar	30	14.3
	Muscat	29	13.8
	Liwa	17	8.1
	Others	5	2.4

Source: Questionnaire

Table 2: Reliability Analysis of the data

	Ν	%
Valid Cases	241	100.0
Excluded	0	0.0

Cronbach's Alpha	N of items
.933	54 items

The test for data reliability and internal consistency confirms that the value is greater than 0.70.

The present study considers factors such as client-related factors, contractors related factors, equipment-related factors, labor-related factors, material related factors, and the Effects of Project completion delay factors. The details of the latent variables (factors) and apparent variables (sub-factors) are given in the table, given below:

Table 3: Details of	f Latent variables	and Apparent variables
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Factors			Sub-factors	
(Latent variables)			(Apparent variables)	
		m1	Shortage of materials in the market	
		m2	Non-availability of materials in the market	
		m3	Change of materials during construction	
Material	related	m4	Delay of raw materials to project site	
factors		m5	The startup got delayed due to non-availability of specific accessories	
		m6	Materials received found to be damaged	
		m7	Delay in work-in-process due to non-availability of materials	
		m8	Work in process materials stay for a longer time	



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	m9	Delay in arranging raw materials according to specification				
	m10	Delay due to finishing materials scarcity				
	e1	Breakdown of equipment				
	e2	Equipment operator's skill is low in this project				
Equipment related	e3	Existing equipment is not effective and leads to low productivity				
factors	e4	The equipment used is not of the latest technology				
Tactors	e5	Improper equipment selection for the project				
	e6	There is a shortage of equipment				
	e7	There is no safety measures environment of using the equipment				
	11	Shortage of labors				
	12	There is an unqualified workforce				
	13	There is an issue with the contract regarding the nationality of labors				
Labor-related factors	14	Labors' productivity level is low				
	15	Personal conflicts among labors				
	16	No motivation for the labors				
	17	Poor linguistic understanding by labors				
	c1	Contractor lacks working capital finance for the project				
	c2	The conflict between the contractor and sub-contractor during the				
		execution phase				
	c3	Review of drawings lead to rework during construction				
	c4	There was a conflict between the contractor and other parties				
Contractors related		(consultant and/or owner)				
factors	c5	Poor site management and supervision by the contractor				
	c6	Poor coordination by the contractor with others				
	c7	Ineffective planning and scheduling of the project by the contractor				
	c8	Contractor's staff not technically qualified				
	c9	Delay by the contractor in spadework towards project execution				
	c10	Unknown delays from subcontractor's side				
	cl1	No proper coordination between the client and other parties				
	cl2	Delay in progress payments release by the owner				
	cl3	Delay in providing services from utilities by the arranger				
	cl4	Project completion time calculated wrongly and time was not sufficient				
	cl5	Time lag due to the delayed decision-making process by the owner				
	cl6	There was a suspension of work by the owner due to poor quality				
	cl7	Delay in revision and approval when change request was made				
Client related factors	cl8	Delay in furnishing and delivering the site to the contractor by the				
		owner				
	cl10	There were conflicts between the joint-ownership of the project				
	cl11	Delay performing inspection and testing				
	pd1	Execution delay may lead to abandonment if issues are not resolved				
	pd2	Inferior quality of materials can lead to project failure				
Effects of Droject	pd3	Disputes and claims for the losses arise due to such delays				
Completion delay	pd4	Delay may end up with a bad reputation				
Completion delay	pd5	Time overrun at the time of completion				
	pd6	Budget overrun during the completion				
	pd7	Improper completion due to high penalties				

The latent variables are also known as constructs that will be tested along with the apparent variables using the measurement model. The conceptual model is shown in figure 1.

The structural model specifies the suppressed constructs. <u>Tenenhaus</u>, <u>Vinzi</u>, <u>Chatelin</u>, <u>and Lauro (2005)</u> defined that measurement model, structural model, and structural regression equation – in the order are used to measure the quality of the model.



Figure 1: Conceptual Model

Measurement Model

Primarily the associations were displayed among the Material related factors, Equipment related factors, Labour related factors, Contractors related factors, Client related factors, and Effects of Project Completion Delay. To test the reliability of the measurement model, discriminant and convergent were validated (Henderson, Sheetz, & Trinkle, 2012).

The coefficients and the values of loading were shown in figure 2 through the obtained initial path model.



Figure 2: Initial Path Model



The reliability of the measurement model was validated by assessing the sub-factors reliability and the factor loadings. A minimum value of 0.45 can be considered preferable for loading of the sub-factors (Comrey & Lee, 2013) but for our study, the sub-factors loading above 0.50 was considered (Hulland, 1999) and those sub-factors with lesser loadings were removed from the model and the resulting final path model is shown in figure 3.



Figure 3: Final Path Model

Reliability

Construct reliability and inner consistency were adjudged using composite reliability as it is more appropriate compared to Cronbachs Alpha (<u>Hair, Sarstedt, Ringle, & Mena, 2012</u>). As per <u>Gefen, Straub, and Boudreau (2000</u>), the least score for composite reliability should be 0.7 and as per <u>Hair, Black, Babin, Anderson, and Tatham (1998</u>) the minimum score for Cronbachs alpha should be 0.6. The factor loadings, composite reliability and Cronbach's alpha values obtained through PLS algorithms were shown in Table 4. As can be seen, Cronbachs alpha value was above 0.755 except Obsessive Passion qualities. It was also seen that the composite reliability score was more than 0.799 except the score of the Obsessive Passion qualities which was close to 0.70. Therefore, the model can be considered trustworthy.

Table 4: Factor loading for indicators of latent constructs

	Factors and Sub-factors	Factor loading	Cronbach's alpha	Composite reliability	AVE
Μ	Material related factors		0.835818	0.88379	0.60373
m2	Non-availability of materials in the market	0.782176			
m3	Change of materials during construction	0.77551			
m4	Delay of raw materials to project site	0.829677			
m5	The startup got delayed due to non- availability of specific accessories	0.761128			
m6	Materials received found to be damaged	0.733318			
Е	Equipment-related factors		0.809912	0.875307	0.637795
e1	Breakdown of equipment	0.80879			
e2	Equipment operator's skill is low in this project	0.829094			
e3	Existing equipment is not effective and leads to low productivity	0.832764			
e4	The equipment used is not of the latest technology	0.718434			
L	Labor-related factors		0.811245	0.8848	0.719797



12	There is an unqualified workforce	0.875807			
13	There is an issue with the contract regarding the nationality of labors	0.887438			
14	Labors' productivity level is low	0.777694			
С	Contractors related factors		0.835115	0.901047	0.752412
c1	Contractor lacks working capital finance for the project	0.874371			
c2	A conflict between contractor and sub-contractor during the execution phase	0.899688			
c3	Review of drawings lead to rework during construction	0.826603			
CL	Client-related factors		0.703965	0.83517	0.628306
cl3	Delay in providing services from utilities by the arranger	0.812976			
cl4	Project completion time calculated wrongly and time was not sufficient	0.760032			
cl5	Time lag due to the delayed decision-making process by the owner	0.803953			
PD	Effects of Project Completion Delay		0.838422	0.885721	0.609042
pd2	Inferior quality of materials can lead to project failure	0.813472			
pd3	Disputes and claims for the losses arise due to such delays	0.754799			
pd4	Delay may end up with a bad reputation	0.867472			
pd5	Time overrun at the time of completion	0.741608			
pd6	Budget overrun during completion	0.715026			

Convergent Validity and Average Variance Extracted (AVE)

To assess convergent validity

- i) The outer loadings should be greater than or equal to 0.70 (Hulland, 1999) and;
- ii) AVE values for every latent variable should be more than 0.50 (<u>Bagozzi & Yi, 1988</u>). 0.4 is acceptable (<u>Fornell & Larcker, 1981</u>) if composite reliability is more than 0.6 (Huang, Wang, Wu, & Wang, 2013).

From Table 4 it can be seen that the variance extracted ranged from 0.60373 to 0.752412, and thus the convergent validity is satisfactory.

Discriminant Validity

Discriminant validity is to ensure that a construct (latent variable) has the strongest relationships than any other construct in the PLS path model. The values of the AVE square root and constructs correlations in Table 5 shows that the constructs Discriminant validity is satisfactory.

				2		
	Client- related factors	Contractor related factors	Equipment- related factors	Labor- related factors	Material related factors	Project Completion Delay factors
Client-						
related	1					
factors						
Contractor						
related factors	0.288509	1				



Equipment-						
related	0.590398	0.424437	1			
factors						
Labor-						
related	0.383894	0.418773	0.547047	1		
factors						
Material						
related	0.585217	0.440914	0.722923	0.57578	1	
factors						
Project						
Completion	0 674710	0 2767	0 662251	0 420284	0 602229	1
Delay	0.074719	0.5707	0.002551	0.429384	0.025558	1
factors						

Structural Model Analysis

Through the path coefficient values, the relationship among the R-square value, independent variable, and dependent variable is tested. The values obtained through the bootstrapping test using PLS are shown in Table 6.

Factors	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	Standard Error (STERR)	T Statistics (O/STERR)	Supported	Significance values	
Client- related > Project completion delay	0.394399	0.390895	0.066246	0.066246	5.953552	Yes	p < 0.05 1.96	
Contractors related > Project completion delay	0.07303	0.074046	0.044725	0.044725	1.632881	No		
Equipment- related > Project completion delay	0.288189	0.291429	0.084389	0.084389	3.415013	Yes	p < 0.05 1.96	
Labor- related > Project completion delay	0.003333	0.001839	0.059316	0.059316	0.056183	No		
Material related > Project completion delay	0.150072	0.155225	0.073675	0.073675	2.036949	No	p < 0.05 1.96	

Table 6: Path coefficients along with their Bootstrap values and T-values

The relationship between the Project completion delay and Client-related factors was supported and significant as $\beta = 0.394399$ and t-value = 5.953552 (> 1.96) at the significance of p at 0.05 level, which indicated that the Project completion delay was positively influenced by the Client related factors. i.e. the Hypothesis No.1 is proved.

The relationship between the Project completion delay and Contractors related factors was insignificant with $\beta = 0.07303$ and t-value = 1.632881 (<1.96) which indicates that the Project completion delay had no influence by Contractors related factors. In other words, the Hypothesis No.2 is disproved.



The relationship between the Project completion delay and Equipment-related factors was supported and significant as $\beta = 0.288189$ and t-value = 3.415013 (>1.96) at the significance of p at 0.05 level, which indicated that the Project completion delay was influenced directly and positively by Equipment related factors. i.e. the Hypothesis No.3 is proved.

The relationship between the Project completion delay and Labor-related factors was insignificant with $\beta = 0.003333$ and t-value = 0.056183 (<1.96) which indicates that the Project completion delay had no influence by Labor-related factors. In other words, the Hypothesis No.4 is disproved.

The relationship between the Project completion delay and Material related factors was insignificant with $\beta = 0.150072$ and t-value = 2.036949 (>1.96) which indicates that the Project completion delay was influenced directly and positively by Material related factors. In other words, the Hypothesis No.5 is disproved.



Figure 4: Bootstrapping Diagram

Assessment of Fit

Goodness-of-fit (GOF) is the overall model fit for PLSEM.

GOF = $\sqrt{\text{average R}^2}^*$ average communality = $\sqrt{0.778 \times 0.692} = 0.732$

Table 7:	Model	Evaluation	Results

Factors	\mathbf{R}^2	Communality	H^2	Redundancy	\mathbf{F}^2		
Client-related		0 628306	0.000		0.000		
factors		0.028300	0.000				
Contractors		0 752412	0.000		0.000		
related factors		0.732412	0.000				
Equipment-		0 637705	0.000		0.000		
related factors		0.037795	0.000				
Labor-related		0 710707	0.000		0.000		
factors		0./19/9/					
Material related		0 60272	0.000		0.000		
factors		0.00375					
Project			0.000		0.000		
Completion	0.579477	0.609042		0.228813			
delay							
Average	0.579477	0.658514	0.000	0.228813	0.000		
GOF - $\sqrt{\text{average R}^2 \text{ x average communality}} = \sqrt{0.579477 \text{ x } 0.658514} = 0.617733$							
Where H^2 is CV-communality index and F^2 is CV-redundancy index							

In PLS, structural model and hypothesis were tested by computing path coefficients β as PLS does not require a normally distributed data, it is evaluated with R² calculation for dependent latent variables (Cohen, West, & Aiken, 2014) and the Average Variance Extracted (Fornell & Larcker, 1981). R² measures a construct's percent variation that is explained by the



model (Wixom & Watson, 2001). A value greater than zero means the model has predictive significance, whereas value lesser than 0 mean that the model lacks predictive significance as presented in figure 5.



Figure 5: Blind Folding Path Diagram

CONCLUSION

From the above analyses and the proven hypotheses, it can be observed that the Construction Project completion delay was mostly by Client-related factors, followed by equipment-related factors and Material related factors.

To be specific,

The Client related sub-factors were Delay in providing services, Delayed decision-making process, Allocation of insufficient time.

The Equipment related sub-factors were Existing low productive equipment, Unskillful Equipment operator, Breakdown of equipment, and Outdated equipment.

The Material related sub-factors were Delay in the supply of raw materials, Non-availability of materials, Change of materials during construction, Non-availability of accessories, and Damaged materials.

Therefore, it is suggested that the clients' cooperation especially in providing the contractors with the necessary equipment, facilities and sufficient time will avoid such delays of the construction projects in Oman.

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