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Measurement Models Evaluation of Performance Measurement and Improvement Framework for Small and Medium Sized Constructors in Developing Countries- A Jordanian Case

Suhair AlKilani
(PhD Candidate, University of New South Wales, Sydney, NSW, Australia)
s.zaidalkilani@unsw.edu.au

Benson Lim
(Senior Lecturer,, University of New South Wales, Sydney, NSW, Australia)
b.lim@unsw.edu.au

Imriyas Kamardeen
(Associate Professor, University of New South Wales, Sydney, NSW, Australia) imriyas@unsw.edu.au

Abstract
Underperformance by Jordanian contractors is a major cause of concern amongst stakeholders in Jordan. There is broad agreement between the stakeholders of the Jordanian construction industry that the lack of a performance measurement tool for Jordanian contractors is a major cause of poor project delivery. The construction industry of Jordan is dominated by small and medium- sized (SM) contractors who face unique challenges in the implementation of projects. This paper presents the development of a contingency- based performance measurement and improvement framework for SM sized construction contractors. Using a stratified sample of 200 Jordanian construction contractor firms, the research framework's reflective measurement models were evaluated by using the construct validation process (the classical validation approach by using the SPSS software and the contemporary validation approach by using partial least squares structural equation modelling technique (PLS-SEM)). On the other hand, the recommended approach for evaluating the formative measurement model was adopted. Overall, 46 out of 103 measurement items were removed with an aim to improve the constructs' reliability and validity. In particular, the results show that the project performance results - as a second (higher) order construct- can be measured by six lower order constructs. In addition, the results show that the contractor's overall business performance is characterized by the profitability and customer satisfaction. On the other hand, internal contingencies/enablers were characterized by four constructs; contractor's technical capabilities, resources and processes, contractor's leadership, contractor's management capabilities, and contractor's human resources management. Further the results revealed that the stakeholders' performance characterized by three constructs; consultant, client, and supplier performance. Finally, the results show that external attributes can be characterized by the task and institutional environment. The results of this research can be used to inform managers and owners of the contracting firms of the most significant internal and external contingencies that impact on their performance. Consequently, appropriate strategies can be established for enhancing performance outcomes and competitiveness. Further, those measurements can be used by the clients and the consultants in their contractors' pre-qualification and selection criteria processes, which help in identifying the competitive contractors with superior performance.

Keywords
Contingency, Contractors, Performance, Task and Instititional Environment, Developing Countries

1. Introduction

The majority of contractors in many construction industries in developing countries fall into the category of small and medium enterprises (SMEs). While many challenges and problems are faced by SM sized contractors all through the world, contractors in developing countries have additional problems to those experienced by their counterparts in developed countries (Hove 2016). Many researchers studied the challenges faced by SM contractors in developing countries The most discussed challenges according to these authors are Financial constraints, Late payment by clients, Lack of resources for training, Lack of management capacity, Poor construction procurement systems, Difficulties to access to new markets facing emerging contractors, Lack of skilled labors, Lack of business planning, High competition from imported goods especially in prices (For example: Hove 2016; Basheka & Tumutegyereize 2012; Thwala & Mofokeng 2012; Ali *et al.* 2010; Arazi Bin Idrus & Sodangi 2010; Idoro 2010; Sebone. & Barry 2009; Thwala & Mvubu 2009; Dlungwana & Rwelamila 2005).

Many researchers argued that by using contractor performance assessment and measurement tools, the endorsement of best practice could be facilitated more effectively (M. R. Lee *et al.* 2014; Demirci. G *et al.* 2009). Many researchers have used existing performance measurement (PM) tools and models, which mainly adapted from the management and business field, and from the existing tools that established for the construction industry. For example Dlungwana & Rwelamila (2002) and Bassioni *et al.* (2005) have used the European Foundation of Quality Management (EFQM) Excellence Model to build their PM model. Ali et al (2012) used Key Performance Indicators (KPIs) framework in their contractors PM model in Saudi Arabia. However, there are no generalized sets of rules in evaluating and measuring contractor's performance. In Jordan, the economy depends almost entirely on SMEs to drive its economy, and the construction industry is not exceptional. In spite of the important role of the construction sector plays within the national economy, poor construction performance, and the sector's limited capacity stifle overall growth. A number of underlying challenges exist within the Jordanian construction sector (Sweis *et al.* 2014). Further, construction companies and their projects are not measured internally or externally; and a significant knowledge gap exists in the industry pertaining to KPIs (Alkilani *et al.* 2015; Alkilani *et al.* 2012). This paper identifies an appropriate set of KPIs to measure contractor performance in the Jordanian construction industry, their internal characteristics, capabilities, resources, and competencies, together with the external contingencies that affect their performance outcomes.

2. Theoretical Background

Many researchers investigated the factors influencing the contractors' performance. Most of the studies assume that endogenous factors such as company resources, capabilities and project management competencies impact on the contractor's overall performance and the success or failure of the project (Sweis *et al.* 2014). However, the complexity and adversity of the current construction industry aggravate the various risks and uncertainties (exogenous factors) faced by contractors, which influence their ultimate performance levels (Nieto-Morote & Ruz-Vila 2012). Only few studies discussed exogenous contingency factors that are unavoidable in a project environment (Hove 2016; Akanni *et al.* 2014). Based on extensive literature review on contractors' performance measurement, the challenges faced by SM sized contractors in developing countries and the factors affect the contractors' performance, both internal and external factors. The framework of this research adopts an integrated approach of various performance measurement models namely: KPIs model (ConstructingExcellence 2009; KPIworkingGroup 2000) to determine the most significant contractor's project and business key performance indicators, EFQM (EFQM 2014), which helped in categorizing the framework constructs into "enablers" with contractor's leadership placed in the front, and "results", which comprises the contractor's performance outcomes at project and business level. In addition it adopts various theories of sources of performance differences namely, resources based view (RBV) (Teece *et al.* 1997; Barney 1991) and competency based theory (Sanchez & Heene 1997; Prahalad & Hamel 1990) to identify the internal factors impact on the contractor's performance (i.e. resources, capabilities, competencies and processes), institutional theory (Scott 1987; Dimaggio & Powell 1983; Meyer & Rowan 1977) and structural contingency theory (Donaldson 2001) to identify the external factors impact on the contractors performance (i.e. task environment and institutional environment). The proposed framework consists of 103 measurement items (observed measures) that grouped under 16 construct, 4 first order constructs were named as "Internal Contingencies/Organizational variables-Enablers), 4 first order constructs were named as "External Contingencies", and the final category which named as Performance outcomes/Results includes 1 second order construct that is overall project performance which comprises 6 lower order constructs with a reflective-formative relationship, and 1first order construct to measure the contractor's business performance "i.e. Contractor's Overall Business Performance".

3. Research Method

A structured questionnaire survey, which written in English language and comprised five section was established and distributed to 200 participants representing SM sized contractors in Jordan. An initial questionnaire survey was piloted through face-to-face meetings with four academics from the researcher's university (University of Technology Sydney UTS), and via meeting with five key stakeholders from the construction industry of Jordan. The comments and the suggestions obtained from the pilot study were appraised and considered during the preparation of the final edition of the questionnaire. All of the questions of the final questionnaire survey were closed-ended questions to acquire accurate and more reliable data from the respondents. The rationale of the questionnaire's structure was established relative to the hypothesized relationships of the theoretical framework developed at the first stage of this research. 5-point Likert scale was used in this questionnaire, to rate the performance level, to measure the organizational performance results, and for rating the impact of external factors**.** A stratified random sampling was employed for selecting the sample of this research. This research employs Partial Least Squares- Structural Equation Modelling (PLS-SEM) as a data analysis method. PLS-SEM is robust for small sample size. However, following a rule of thumb for the minimum sample size that is "10 times rule" (Hair *et al.* 2013) that the minimum sample size should be 10 times the maximum number of arrowheads pointing at a latent variable in the PLS path model, a sample of 200 was selected, which was greater than the 10 times rule.

4. Data Analysis

This research framework comprises first order constructs, and second order constructs (i.e. HOC). All the first order constructs are reflective measurement models, as indicated by the arrows pointing from the construct to the indicators(Chin 1998). Evaluating the reflective first order measurement model was conducted by adapting (Lim *et al.* 2011; Lim 2010; O'Leary-Kelly & J. Vokurka 1998) approach. Whereas two main validation approaches were adopted to assess the adequacy of individual sets of measurement items in capturing their respective constructs in terms of their Unidimensionality,
Reliability, and Validity. They are the classical validation approach (i.e., Cronbach's alpha and exploratory factor analyses EFA) by using the SPSS software, and the contemporary validation approach (i.e., the confirmatory factor analysis CFA) via partial least squares structural equation modelling (PLS-SEM) by using SmartPLS3.0 software. Within these processes, six indexes were used to assess the reliability and validity of measurement items: factor loading must be at least 0.7 (Comrey 1973) and is significant at $p < 0.05$ (Anderson & Gerbing 1988); Cronbach's alpha coefficient must be at least 0.70
(Nunnally 1978)); the composite reliability score must be at least 0.70 (Hair *et al.* 2013; Hair *et al.* 2011);

the average variance extracted (AVE) value must be at least 0.50 (Fornell & Larcker 1981); discriminant validity (i.e. Squared root AVE in the diagonal scores should more than the off-diagonal score) (Chin 2010),and cross loading more than the recommended value of (0.4) (Chin 2010; Hair 1998a). On the other hand, the second order construct (i.e. HOC that is overall project performance -OverallProj) has a formative measurement model, as indicated by the arrows pointing from the LOCs to the HOC. The rationale for selecting formative relationships to link the LOCs to the HOC was mainly because the combination of those LOCs led to the formulation of the HOC as general construct (Hair *et al.* 2011). In addition, this research aims at investigating the influence of those LOCs on a target variable that is the contractor's business performance (OverallBus). Therefore, it is most appropriate to use the formative relationship between LOCs and HOC, where this HOC (i.e. OverallProj) can act as a general construct that represent all the LOCs as recommended by (Hair *et al.* 2013; Becker *et al.* 2012). The procedure by Hair *et al* (2013) will be adopted to assess the formative measurement model, which includes two main tests: (i) Collinearity assessment between the LOCs, and (ii) the LOCs outer weights and their significance via bootstrapping and t-statistics.

4. Participant Profiles

The profiles of respondents are shown in Table 1. The targeted population for this study was those local contractors who operated within the Jordanian construction industry and classified under Grade 1, 2, 3, and 4 of the Jordanian Contraction Contractor's Association (JCCA) registry. There are 200 participants representing local contractors firms. Of these 72 are from Grade 1, 58 from Grade 2, 39 from grade 3, and 31 are from Grade 4. According to the JCCA (2014) annual report, there are 458 local contractors, who classified under Grade 1, 2, 3, and 4. Therefore, the sample involved represents a reasonable rate of 43.7% (i.e. 200 out of 458 local contractors).

Table 1: Participants Profile

Characteristics	Frequency	Percent %
Highest Degree of Education		
Bachelor’s degree (e.g. engineering, architecture)	114	57.0
Master’s degree	54	27.0
Professional certificate (e.g. Project Management Professional (PMP) Certificate)	26	13.0
Doctorate degree	6	3.0
Grade of Classification		
Grade 1	72	36.0
Grade 2	58	29.0
Grade 3	39	19.5
Grade 4	31	15.5
Firm Size		
Small (11-49) Staff	173	86.5
Medium (50-100) Staff	27	13.5

5. Evaluating the Reflective First Order Measurement Models Results

For the following sub-section, the results of evaluating the reflective measurement models are presented in Table 2 and Table 3. For each measurement item, two sets of scores will be reported for the above statistical tests (see section 4). In this case, the scores in brackets show the relevant scores of Cronbach's alpha, eigenvalue, and variance for each construct, the individual measurement items' factor loading resulted from the classical approach. In addition, factor loading and its corresponding t-statistics, composite reliability, EVA, and discriminant validly before the removal of the inconsistent measurement items.

Table 2: First Order- Reflective Measurement Models Evaluation Results

Item Code	Constructs and corresponding Items	Factor Loading	Eigenvalue	Variance %	Indicator Reliability		Internal Consistency	Validity
					Factor Loading	*T*-Statistic	Composite Reliability	Convergent validity
Project Cost Performance (ProjCost) Cronbach's alpha 0.768 (0.764)			2.073 (2.391)	69.094 (59.774)			0.870 (0.870)	0.691 (0.691)
Q411	Cost variation (beneficial to contractor's profit)e.g. cost overrun, cost at completion in cost-plus contract	0.836 (0.810)			0.834 (0.835)	35.481		
Q413	Construction cost (building cost only)	0.790 (0.744)			0.792 (0.791)	32.335		
Q414	Cost saving from innovation	0.866 (0.858)			0.866 (0.866)	32.401		
	Project Time Performance (ProjTime) Cronbach's alpha 0.897 (0.891)		3.572 (3.968)	71.449 (66.136)			0.925 (0.925)	0.713 (0.713)
Q421	Time variation	0.860 (0.849)			0.844 (0.844)	21.723		
Q422	Speed of construction	0.909 (0.902)			0.902 (0.902)	79.06		
Q423	Construction time	0.86 (0.853)			0.875 (0.875)	52.656		
Q425	Change order time	0.873 (0.683)			0.861 (0.861)	42.051		
Q426	Time saving from innovation	0.706 (0.702)			0.73 (0.730)	20.003		
	Project Quality Performance (ProjQual) Cronbach's alpha 0.860 (0.843)		2.380 (2.759)	79.332 (68.972)			0.920 (0.920)	0.852 (0.793)
Q433	Frequency of quality control test passed/fail	0.902 (0.88)			0.924 (0.902)	108.037		
Q434	Number of change requests and root cases	0.885 (0.867)			0.922 (0.885)	97.15		
	Project Health and Safety Performance (ProjH&S) Cronbach's alpha 0.863 (0..808)		2.410 (2.597)	80.349 (64.918)			0.916 (0.924)	0.845 (0.803)
Q443	Recorded number of safety meetings	0.912 (0.903)			0.932 (0.916)	134.315		
Q444	Number of accidents on each site	0.874 (0.852)			0.907 (0.865)	73.242		
	Project Environmental Sustainability Performance (ProjEnv) Cronbach's alpha 0.850 (0.845)		2.771 (3.400)	69.264 (56.671)			0.900 (0.900)	0.692 (0.692)
Q462	Construction waste and disposal processes	0.805 (0.809)			0.810 (0.810)	29.258		
Q464	Product compliance with certification and standards	0.822 (0.793)			0.808 (0.808)	28.284		

Q465	Use of recyclable materials	0.911 (0.882)			0.906 (0.906)	77.723		
Q466	Number of environment lawsuits	0.785 (0.753)			0.799 (0.800)	31.871		
	Project Socio-economic Contribution (ProjSocEco) Cronbach's alpha 0.763 (0.729)		1.625 (2.238)	81.246 (55.947)			0.896 (0.896)	0.812 (0.812)
Q471	Company contribution to the country's domestic product (GDP)	0.901 (0.624)			0.887 (0.886)	53.208		
Q472	Contribution to employment generation (number of employees)	0.901 (0.667)			0.915 (0.916)	106.523		
	Business Performance Results (OverallBus) Cronbach's alpha 0.730 (0.707)		1.889 (2.323)	58.184 (46.459)			0.836 (0.836)	0.630 (0.629)
Q51	Profitability	0.802 (0.766)			0.793 (0.793)	27.312		
Q481	In our organisation, clients are usually satisfy with the final outcomes and	0.785 (0.714)			0.797 (0.798)	33.851		
Q482	In our organisation, consultants are usually satisfy with the final outcomes	0.793 (0.757)			0.790 (0.789)	29.156		
	Contractor's Organisational Characteristics (Enablers) Cronbach's alpha **0**.967 (0.959)		Cumulative Variance % 78.61(49.34)					
	Contractor's Technical Capabilities, Resources and Processes (ConTachPros) Cronbach's alpha 0.968		13.49 (16.08)	51.81 (36.364)			0.960 (0.973)	0.856 (0.748)
Q336	We have a good record of number of past successful projects	0.804 (0.763)			0.895 (0.853)	81.94		
Q337	Our organisation has a good company capacity in terms of equipment, plants, and other resources	0.826 (0.794)			0.955 (0.942)	180.476		
Q338	In our organisation we have good financial resources and assets to cover projects (financial Stability is maintain good)	0.842 (0.8130)			0.946 (0.915)	147.359		
Q352	Business processes are systematically managed (e.g. establishing a process management system and system standards…etc.)	0.782 (0.723)			0.902 (0.885)	84.116		
	Contractor's Leadership (ConLead) Cronbach's alpha 0.930		4.182 (4.63)	16.15 (11.83)			0.943 (0.943)	0.736 (0.734)
					0.861 (0.891)	35.672		
Q311	Leaders develop and communicate mission, vision, and values (e.g. communicate these effectively with others)	0.812 (0.784)			0.861 (0.856)	21.787		
Q312	Leaders are actively involved with client (e.g. identify client's needs…etc.)	0.820 (0.796)			0.904 (0.906)	21.217		

Q313	Leaders are actively involved with stakeholders (e.g. Managing relationships…etc.)	0.902 (0.88)			0.906 (0.910)	17.12		
Q314	Leaders are actively involved in ensuring management systems are developed, implemented and improved	0.921 (0.913)			0.789 (0.793)	11.193		
Q315	Leaders create an environment for empowerment, innovation, learning and support (e.g. believe in oneself and one's ability)	0.821 (0.812)			0.779 (0.783)	10.027		
Q317	Leaders measure company performance and translate results into improvements	0.82 (0.816)			0.861 (0.891)	35.672		
	Contractor's Management Capabilities (ConMang) Cronbach's alpha 0.846		1.580 (1.75)	6.18 (4.47)			0.939 (0.939)	0.793 (0.793)
Q321	In our organisation supply chain management methods is identified and improved	0.776 (0.767)			0.898 (0.898)	56.349		
Q322	In our organisation risk management strategies are planned and evaluated	0.762 (0.759)			0.875 (0.875)	45.377		
Q332	We have high level of employees with excellent management experience and advanced skills	0.825 (0.801)			0.891 (0.891)	46.169		
Q333	We have project management software and programs in our organisation	0.841 (0.828)			0.897 (0.897)	56.349		
	Contractor's Human Resources Management (ConHRM) Cronbach's alpha 0.985		1.153 (1.42)	4.39 (3.63)			0.990 (0.990)	0.971 (0.971)
Q342	Our organisation provides adequate training to those performing new tasks…etc.)	0.828 (0.824)			0.988 (0.988)	251.885		
Q343	In our organization, employees are rewarded and recognized	0.796 (0.786)			0.98 (0.980)	169.971		
Q344	In our organisation teamwork is encouraged and enabled	0.827 (0.823)			0.988 (0.988)	252.03		
	Stakeholders Performance (Moderators) Cronbach's alpha 0.891 (0.877)		Cumulative Variance % 69.70 (54.99)					
	Consultant Performance (ConsPerf) Cronbach's alpha 0.896		5.249 (7.247)	40.588 (30.196)			0.921 (0.921)	0.660 (0.659)
Q541	Technical and management competences	0.819 (0.809)			0.839 (0.838)	30.914		
Q542	Ability to meet programmed milestones	0.767 (0.764)			0.815 (0.815)	29.732		
Q543	Quality of design and documents	0.766 (0.748)			0.772 (0.772)	22.243		
Q545	Good working relationships	0.810 (0.796)			0.870 (0.871)	36.735		
Q546	Proper communication	0.757 (0.715)			0.802 (0.770)	19.084		
Q549	Provision of design documentation and specification prior to construction	0.803 (0.796)			0.802 (0.801)	18.353		

	Client Performance(ClinPerf)		2.09	16.08			0.913	0.726
	Cronbrach's alpha 0.872		(2.297)	(9.57)			(0.913)	(0.726)
Q521	Change orders	0.822			0.777	17.273		
		(0.771)			(0.776)			
Q522	Regular payments	0.778			0.762	17.616		
		(0.736)			(0.763)			
Q525	Effectiveness of product design	0.857			0.932	74.384		
		(0.829)			(0.932)			
Q526	Quality and commitments from client employees	0.833			0.923	81.664		
		(0.803)			(0.923)			
	Supplier Performance (SupPerf)		1.819	13.99			0.896	0.682
	Cronbrach's alpha 0.848		(2.409)	(10.04)			(0.896)	(0.682)
Q531	Replacement value	0.734			0.858	38.164		
		(0.723)			(0.858)			
Q532	Number of product defects	0.759			0.836	29.182		
		(0.741)			(0.836)			
Q533	Delivery time	0.868			0.779	15.093		
		(0.799)			(0.779)			
Q537	Use of latest technology	0.895			0.828	19.639		
		(0.839)			(0.828)			
	External Attributes Influence (ExtAttr)		3.578	71.553			0.926	0.715
	Cronbrach's alpha 0.900 (0.882)		(3.783)	(63.043)			(0.926)	(0.715)
Q551	Regulations, policies and laws	0.895			0.879	48.342		
		(0.882)			(0.880)			
Q552	Material prices fluctuation and material modification specification changes	0.862			0.861	48.085		
		(0.846)			(0.860)			
Q553	Financial Consideration (e.g. Little Government Financial Support)	0.901			0.901	53.276		
		(0.886)			(0.900)			
Q555	Business Environment (bureaucracy)	0.845			0.830	30.257		
		(0.839)			(0.830)			
Q556	High tax rates	0.735			0.750	20.41		
		(0.711)			(0.750)			

Table 3: Squared Root of AVE and Constructs Correlations

	ClientPer	ConHRM	ConLead	ConMang	ConTachPros	ConsPerf	ExtAttr	OverallBus	ProjCost	ProjEnv	ProjH&S	ProjQual	ProjSocEco	ProjTime	SupPerf
ClientPer	**0.852 (0.852)**														
ConHRM	0.486 (0.486)	**0.985 (0.985)**													
ConLead	0.230 (0.228)	0.175 (0.174)	**0.857 (0.858)**												
ConMang	0.458 (0.458)	0.564 (0.564)	0.160 (0.1570	**0.89 (0.890)**											
ConTachPros	0.543 (0.562)	0.731 (0.732)	0.247 (0.298)	0.658 (0.677)	**0.925 (0.865)**										
ConsPerf	0.429 (0.429)	0.396 (0.396)	0.253 (0.250)	0.420 (0.421)	0.448 (0.476)	**0.812 (0.812)**									
ExtAttr	0.395 (0.394)	0.504 (0.504)	0.347 (0.344)	0.466 (0.466)	0.724 (0.747)	0.384 (0.384)	**0.846 (0.846)**								
OverallBus	0.506 (0.506)	0.672 (0.672)	0.323 (0.320)	0.585 (0.585)	0.828 (0.843)	0.430 (0.431)	0.675 (0.675)	**0.793 (0.793)**							
ProjCost	0.509 (0.509)	0.667 (0.667)	0.324 (0.321)	0.651 (0.651)	0.826 (0.852)	0.483 (0.484)	0.676 (0.676)	0.777 (0.777)	**0.831 (0.831)**						
ProjEnv	0.560 (0.560)	0.644 (0.644)	0.291 (0.288)	0.640 (0.640)	0.845 (0.861)	0.486 (0.486)	0.678 (0.678)	0.745 (0.745)	0.785 (0.785)	**0.832 (0.832)**					
ProjH&S	0.458 (0.506)	0.620 (0.669)	0.239 (0.244)	0.718 (0.739)	0.804 (0.867)	0.435 (0.450)	0.556 (0.608)	0.693 (0.741)	0.779 (0.817)	0.738 (0.776)	**0.919 (0.896)**				
ProjQual	0.552 (0.566)	0.673 (0.702)	0.278 (0.306)	0.696 (0.678)	0.855 (0.920)	0.484 (0.513)	0.656 (0.687)	0.782 (0.809)	0.814 (0.835)	0.804 (0.824)	0.805 (0.856)	**0.901 (0.891)**			
ProjSocEco	0.484 (0.484)	0.643 (0.643)	0.317 (0.315)	0.625 (0.625)	0.806 (0.837)	0.414 (0.414)	0.596 (0.596)	0.764 (0.764)	0.764 (0.764)	0.759 (0.759)	0.727 (0.764)	0.787 (0.812)	**0.901 (0.901)**		
ProjTime	0.510 (0.510)	0.562 (0.562)	0.255 (0.252)	0.632 (0.632)	0.789 (0.804)	0.421 (0.421)	0.598 (0.598)	0.726 (0.726)	0.704 (0.704)	0.746 (0.746)	0.704 (0.747)	0.703 (0.744)	0.71 (0.710)	**0.845 (0.845)**	
SupPerf	0.331 (0.331)	0.391 (0.391)	0.177 (0.174)	0.483 (0.483)	0.524 (0.539)	0.361 (0.361)	0.394 (0.394)	0.459 (0.459)	0.447 (0.447)	0.518 (0.518)	0.471 (0.470)	0.493 (0.523)	0.481 (0.481)	0.483 (0.483)	**0.826 (0.826)**

5.1 Classical Approach Results

Overall, 35 out of 103 measurement items were removed with an aim to improve the constructs' reliability and validity. Justifications of the removal based on the results of the reliability test (Cronbach's alpha values) and the results of EFA (factor loading ≥ 0.7 (Tabachnick 2007; Comrey 1973), Eigenvalue >1 and Scree plot (Cattell 1966) , Variances (50%-60%) (Hair 1998b)) for each construct. The constructs corresponding to performance outcomes/results were entered separately to EFA, all the measurement items corresponding to each construct rotated to one factor as resulted from EFA. All the measurement items under internal contingencies were entered to one EFA, the results revealed four factors. In addition, all the measurement items corresponding to stakeholders performance entered to EFA that revealed three rotated factor. Finally, the measurement items corresponding to external attributes construct were entered to EFA, which rotated one factor. The results of this validation stage were used to confirm the reliability and the convergent validity of the constructs. Other tests will be explained in the contemporary validation approach (See section 5.2) via CFA, which will further test the reliability, convergent validity, and the discriminant validity of the reflective measurement models.

5.2 Contemporary Approach Results

The returned constructs and their corresponding measurement items from the classical validation approach formed the input for the contemporary validation approach. This approach uses the CFA via PLS modelling technique. Overall 11 measurement items out of 68 measurement items were removed to with an aim to improve the constructs' reliability and validity.

Reliability (Composite reliability) and Convergent Validity (Factor Loading, t-statistics and Average Variance Extracted AVE)

Composite reliability was used to assess the internal reliability of the measurement models. It can be seen from Table 2, that the coefficients related to the composite reliability before deleting any measurement items were high (ranging from 0.81 to 0.99) and above the advocated threshold of 0.7 (Hair *et al.* 2013) for each one of the constructs. Thus suggesting satisfactory level of composite reliability. The factors loading for all the items for the first order constructs (before deleting problematic measurement items) were above the recommended threshold of 0.7 (Hair *et al.* 2013; Chin 2010; Chin 1998), ranging from (0.75 to 0.988). In addition, it can be seen that *t*- statistics of all individual measurement items are greater than 2.430 (i.e., the *t*-test values required to achieve statistical significant at $p < 0.05$). All the constructs' AVE values before deleting the problematic measurement items exceed the threshold of 0.5 (Hair *et al.* 2013). Ranging from (0.659 to 0.971). This means that at least 50% of measurement variance is captured by individual constructs involved, thus indicating a satisfactory level of convergent validity. Although the above results indicating a satisfactory level of convergent validity and reliability, but as recommended by advocates in PLS, for making a decision on retaining the measurement items, the discriminant validity of each construct in the measurement model should be assessed beside the internal reliability and the convergent validity.

Discriminant Validity (Squared root of AVE and Cross loading)

To assess the model's discriminant validity, two tests were performed; the Fornell-Larcker (1981) that is the squared root of AVE; and the Cross-loading (Henseler *et al.* 2015; Hair *et al.* 2011; Chin 2010). Table 3 shows the results of the squared root of AVE and the constructs' correlations. In this table, two scores are presented (one before dealing with problematic items (between brackets), and one after dealing with problematic items (the score on top). As illustrated in Table 3, the model failed the Fornell-Larcker test for three construct (i.e the off-diagonal scores (correlations) of some of the constructs corresponding to the respective columns of those three constructs (i.e. ContTechPros, OverallBus and ProjCost) were greater than the diagonal scores (i.e. squared root of AVE) of those constructs (i.e. ContTechPros, OverallBus and ProjCost), which means failing the Fornell-Larcker test (Hair *et al.* 2013). This means there were constructs' correlations larger than the square root of those constructs' AVE, which identified between ContTechPros (squared AVE of 0.865) and ProjQuality (correlation of 0.920), and ProjH&S (correlation of 0.867). In addition, between OverallBus (squared root of AVE 0.793) and ProjQual (correlation of 0.809), and finally between ProjCost squared root of AVE (0.831) and ProjQual (correlation of 0.835). Further, when investigating the measurement items' cross loading results and by following the recommended approach by Chin (2010), which based on examining both of the factor loading (outer loading in PLS modelling) and the shared variance (Square the factor loading) of the measurement items in their respective constructs and among other constructs in the measurement model. It was noted that the measurement items related the constructs that failed Fornell-Larcker test, had cross loading among those constructs.

Following the recommended approach by advocates in PLS (Hair *et al.* 2013; Ringle *et al.* 2012; Hair *et al.* 2011; Chin 2010; Chin 1998). The decision was made to omit (remove) the problematic measurement items with an aim to handel discreminant validity and therfore to increase the measurement model's reliability and quality. As it can be seen from Table 3, the results of discriminant validity via Fornell-Larcker test after deleting the problematic items show that the square roots of AVE of all constructs in PLS model are greater than the off diagonal scores in the corresponding columns, suggesting stong discriminant validity of the measurement model. Further, to reinforce the above conclusion, the cross loading generated for the measurement model after deleting the problematic items showed that all the measurement items loaded higher on the construct that they were specified to measure than any other constructs in the models. This further demonstrates a strong evidence of discriminate validity. Considering the results of the after deleting the problematic measurement items. It can be concluded that there no further corrective action is required in PLS first order constructs measurement model.

6. Evaluating the Formative Second (higher) Order Construct

The analysis of the HOC follows the assessment procedure as drawn from (Hair et al. 2013; Chin 2010) (See Section 4). Mainly Collinearity analysis between the HOC and the LOCs was performed, where the outer Variance Inflation Factor (VIF) scores were obtained to show the Collinearity of LOCs to their higher order construct. In addition, the path analysis was performed to obtain the outer weights of LOCs, followed by bootstrapping analysis to show their significance via t-statistics. As shown in Table 4, all LOCs have a VIF value of less than the threshold value of 5. Therefore, this suggests that Collinearity is not a major issue. All the LOCs' outer weights are significant at 0.05 two-tailed t- level ranging from 2.138 to 4.199. Therefore, the assessment results of the second order construct indicate it is valid and reliable.

Table 4: LOCs VIF values, outer weights and t-statistics results

LOCs	VIF	Outer Weights	T statistics	P values
ProjCost -> OverallProj	3.977	0.171	3.00	0.003
ProjTime -> OverallProj	2.780	0.218	4.199	0.000
ProjQual -> OverallProj	4.703	0.234	3.534	0.000
ProjH&S -> OverallProj	3.500	0.181	3.800	0.000
ProjEnv -> OverallProj	3.867	0.209	3.977	0.000
ProjSocEco -> OverallProj	3.340	0.106	2.138	0.030

7. Conclusions

The result of the classical and contemporary validation approaches show that the conceptual framework is valid and reliable. Overall, 46 out of 103 measurement items were removed with an aim to improve the constructs' reliability and validity. In particular, the results show that the project performance results - as a second (higher) order construct- can be measured by six lower order constructs; project cost performance, project time performance, project quality performance, project health and safety performance, project environmental sustainability performance, and project socio-economic contribution. In addition, the results show that the contractor's overall business performance is characterized by the contractor's profitability, client satisfaction, and consultant satisfaction. On the other hand, the results show that the organizational characteristics characterized by four constructs; contractor's technical capabilities, resources and processes, contractor's leadership, Contractor's management capabilities, and Contractor's human resources management. Further the results revealed that the stakeholder's performance characterized by three constructs; consultant performance, client performance, and supplier performance. Finally, the results show that external attributes can be characterized by the business environment, the government laws and regulations, the tax rates, financial consideration, material prices, and specification fluctuation. Those results helped in achieving the second objective of this research (i.e. designing and testing the conceptual framework of performance measurement and improvement for SM contractors in developing countries).

The results of this research can be used to inform managers and owners of the contracting firms of the most significant internal and external contingencies that impact on their performance. Consequently, appropriate strategies can be established that consider those factors with main goals of enhancing performance outcomes and competitiveness. Further, the results of this research identified the most critical performance outcomes that can be used by the contractors themselves to measure and benchmark their project and business outcomes. Further, those measurements can be used by the clients and the consultants in their contractors' pre-qualification and selection criteria, which help in identifying the competitive contractors with superior performance. In addition, the measurement items and their corresponding constructs that related to the internal and external contingencies, which were established based in various theories of sources of performance heterogeneity and homogeneity (i.e. RBV, competency theory, institutional theory and contingency theory) confirm that integrating various aspects of theories is applicable and useful in developing a comprehensive performance measurement and improvement framework for SM construction contractors. Finally, the results confirm the benefits and the strengths of the adapted methodology in evaluating the measurement models, which comprise classical and contemporary approaches for construct validation process. It is recommended that other researchers in the field of construction management and in particular who use PLS-SEM for their analysis to consider this approach for their measurement models' evaluation.

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