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THE IMPACT OF THE PROJECT MANAGEMENT KNOWLEDGE AREAS ON THE PERFORMANCE OF THE KEY PLAYERS IN CONSTRUCTION PROJECTS

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A B S T R A C T

A typical construction project has associated key players whose inputs are needed to improve project management effectiveness. The project performance of these key players is impacted by a number of dynamic factors which may be tangibles or intangibles. This research study assessed the impact of the project management knowledge areas on the project performance of construction industry's key players. A questionnaire was administered to 250 selected project management personnel from 10 randomly selected companies in the construction sector in the North Central Zone of Nigeria operating over the last decade. The valid responses obtained from the respondents were 213. Altogether, 12 latent variables and 52 manifest or observed variables were used for the data analysis after the preliminary data analysis to check the validity, reliability and reduce the number of variables using the average variance extracted (AVE), the Cronbach's alpha test, the composite reliability test and exploratory factor analysis in Microsoft Excel and the statistical package for the social sciences (SPSS) respectively. The result of the structural equation model (SEM) in linear structural relationship (LISREL) software used to test 29 hypotheses indicates that skillfulness in the utilization of the project management knowledge areas by the key players in construction projects improves their project performance. This is because 23 of these hypotheses were validated and only 6 were rejected because of unacceptable path coefficients. It was identified that the strongest relationships exist in the interaction of the client and quality management, the client and cost management, the client and communication management, the consultant and communication management and the project manager and quality management in the order of their path coefficients.

1. INTRODUCTION

All over the world, the construction industry is viewed as one of the economic derivers of a nation's economy because of its contribution to national growth by increasing the output, income and employment (Unegbu et al., 2020a). As such, the number of construction projects undertaken in a nation is a measure of the rate of development. This demands that the project participants should be highly effective at their job because their

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performance is linked to the performance of the national economy. The contemporary business environment is very dynamic, thus, necessitating the need for the construction industry globally to continually evolve means of managing their projects effectively in the midst of increasing demand for quality to satisfy the multifaceted expectations stakeholders (Jeremiah and Kabeyi, 2019). Construction projects generally involve different categories of project participants of which the key players have been identified as the client or project owner, the consultant, sub-contractors and contractor whose activities greatly determine or influence project success (Jin et al., 2017). It therefore implies that the extent to which these participants are grounded in the concepts, processes and procedures of project management will positively impact project success because according to the Project Management Institute in their Guide to the Project Management Body of Knowledge, PMBOK Guide, skillfulness in the application of the project management practices by the project participants greatly improves project outcomes (PMI, 2017).

Based on the foregoing, it is imperative to develop a strategic framework that experimentally examines the factors that impact the key players of construction projects and to identify the impacts of their skillfulness in the project management knowledge areas as contained in the PMBOK, on their project performance. The main focus of this study is to identify the strength of the impact of the knowledge of the project management practices on the project performance of the key players in construction projects and on overall project performance. It is assumed that the rating of the multivariate used for the study will vary across the respondents based on their experience, number of projects handled and complexity of projects previously undertaken (Unegbu et al., 2020). This also translates to the fact that the knowledge and expertise of the key players in the utilization of the project management practices in managing projects varies. By achieving the above-mentioned objectives, the key players in construction projects will gain more insight on the impacts of the knowledge and application of project management practices on their project performance. This will in addition motivate them to gain more knowledge and expertise in this aspect in order to improve their project performance.

2. CONCEPTUAL FRAMEWORK

2.1 The Project as a Concept

The concept of project has gained a wide range of attention in literature resulting in different perspectives of the definitions. The International Project Management Association (IPMA) defined it as an organized effort aimed at achieving a predefined output which is exposed to constraints (IPMA, 2015). This is a very detailed definition that recognized the characteristics of a project as unique, transient, consisting of organized interrelated activities, involving several disciplines and constrained by certain factors. It also gave room for flexibility in the nature of the output by referring it as agreed deliverables. One of the most acceptable definitions viewed a project as engagement taken to produce a unique product, result or services (PMI, 2017). Looking at this definition of a project, it could be said that it is characterized by transiency (a definite start and completion time), multidisciplinary nature, unknown elements which creates risks, a change, problem solving or utilization of opportunity, utilization of limited resources, achievement of set goals and objectives, uniqueness of product, service or result, and novelty in the way the interrelated set of activities are completed (Unegbu et al., 2021).

According to Prabhakar (2008), a project could be classified on the bases of complexity, size, level of risks in the project, and the level of involvement of customers. Thus, a project could be complex, large, high risk or customer focused as the case may be. Every project has a life cycle comprised of different phases through which the project must pass through to completion (PMI, 2017). Different categories of project phases exist which is often determined by the kind of industry, size of project, the nature of the output, and such like, but the most popular is that contained in Kerzner (2003), consisting of conceptual, planning, testing, implementation or execution and closure. This sequence of project phases is aligned to that contained in PMI (2017) which are: initiating, planning, monitoring and controlling, execution and closing processes.

2.2 Project Management

There are different views and perspectives of the definition of project management, but the most commonly accepted definitions are those from professional bodies. The Association of Project Management viewed project management from the perspective of the process that is followed in order to achieve the desired output of a project which include planning, execution, monitoring and control and closure (APM, 2016). This implies that project management is targeted at how best to approach the project so as to achieve the desired expectations of the stakeholders. Project management is viewed as the utilizations of tools, methods, techniques and skills in implementing the activities of a project with the aim of actualizing the stakeholders' expectations (PMI, 2017). This in their perspective demands that a project should pass through five phases consisting of a series of activities from the start to completion. It is concerned with how best to implement project activities so as to attain optimal performance

The origin of project management could be traced to the military defense industry in their attempt to effectively respond to national security needs (Chou & Yang, 2012). Since then, project management has developed over the years to become a fully recognized discipline with tools,

techniques and methods that improve the management of project activities and resources to achieve the defined outcomes of projects (Unegbu et al., 2021). Thus, effective project management has become an imperative in project-based industries like construction, manufacturing, and many other industries basically because it facilitates the realization of project deliverables (Isik et al., 2008). The most widely accepted of these guides is the Guide to the Project Management Body of Knowledge (PMBOK Guide) which is an initiative of PMI that consist of ten knowledge areas which are integration, stakeholder, procurement, communication, time, cost, human resource, quality, scope and risk management (PMI, 2017). It contains best practices that has the capacity to enable business organization to achieve the much-needed results in managing their projects. Therefore, it is believed that the right applications of the practices, tools and methods contained in these knowledge areas to project activities will result in improved effectiveness and efficiency of project management and achievement of the expectations of project stakeholders (Chou & Yang, 2012). According to Zwikael (2009), a good knowledge and right applications of the practices contained in the PMBOK Guide enhances the performance of project managers and project team, and promotes project success.

2.3 The Key Players in Construction Projects

Construction project management is multidisciplinary in nature because of the diversity of the project activities which demand expertise from professions such as Mechanical and Electrical Engineering, Quantity Surveyor, Architecture, and Civil and Structural Engineering (Chua et al., 1999). These professions constitute the different components of construction project (Hwang & Lim, 2012). Apart from these professionals, there are individuals, group or organizations which have been identified as being at the center of every project based on their level of involvement and concern for the project outcome. These are referred to as the key players which are the project owner or client, the consultant and the contractor (Jin et al., 2017). The owner or client is an entity, individual or organization that initiated the project and provides the funding (CIOB, 2016), and in addition, demonstrates great control over the project. The contractor is an individual or organization with the expertise required to complete a project, whose services is engaged by the client or owner for this purpose (Farmer, 2016). On the other hand, a consultant is an individual who provides advice professionally in a specific field with the aim to identify problems, offer solutions and in some cases help in the implementation of the solution (Consultancy.uk, 2018).

They are considered because their level of involvement and commitment to the project outcome is higher than that of the rest of the participants in construction projects. Therefore, the attainment of their expectations concerning the project supersedes the expectation of others. This implies that the realization of the performance expectation as defined in the project objectives depends on the effectiveness of these key players, which in turn is determined by their level of exposure to the management of construction projects (Unegbu et al., 2020a). It is therefore imperative to assess the factors which potentially impact the activities of project key players and ensure that their performance at projects is optimally maintained in order to consistently realize project objectives.

2.4 Review of Related Literatures

Unegbu et al. (2021) investigated the relative importance of the project management practices to construction projects and the relationship between the project management knowledge areas using the relative importance index and structural equation model. Their research finding showed that the utilization of the project management practices in the construction industry resulted in improved project performance. The structural equation model indicated that the management of communication has a positive impact on the rest of the project management knowledge areas with the strongest relationship existing between communication management and procurement management. Alwaly and Alawi (2020) identified the factors affecting the effective implementation of the project management knowledge areas contained in the PMBOK Guide in the construction industry in the developing country Yemen. The result of their data analysis which was focused on identifying the level of implementation of the PMBOK Guide showed that the construction companies sparsely applied the project management practices in managing construction projects with quality management and closing processes emerging with highest ranks. It also attributed this outcome to lack of qualification and poor training of the project management professionals in contemporary trends in project management, hence, they recommended the need for regular training and project management certification to be emphasized by the project organizations. Unegbu et al. (2020b) studied the relationships existing between the critical success factors and the project performance measures for construction projects using structural equation model. Their research result revealed that factors connected with the consultant have the highest level of impact on project performance. This was followed by the factors connected with the project manager, contractor and client in the order of decreasing path coefficient. (Kog & Loh, 2012)

Hwang and Lim (2013) studied the factors critical to the success of the key players in construction projects based on different objectives of construction projects (quality, schedule and budget performance) using analytic hierarchy process (AHP). The key players considered in the study were the contractor, consultant and client or owner. Their research findings revealed that the satisfaction of project owners was the most important

factor for the consultants for both quality, schedule and budget performances. It also indicated that the contractors rated schedule performance above quality and budget performances. In other words, the performance of schedule is preferred by the contractors over the performance of quality and budget. Examining the impact of project management knowledge on the performance of construction projects, Chou and Yang (2012) carried out an empirical research study using structural equation model. This research was focused at investigating the potency of the project management tools, techniques, methods and skills with respect to the implementation of building and infrastructural projects. The data analysis results indicated that the application of the project management practices contained in the PMBOK Guide to construction projects improves project performance, project success and customer satisfaction.

The foregoing literature review indicates that though a reasonable level of research has been carried out on the impact of the utilization of project management practices in construction projects, there was none that focused on the impact of the project management knowledge areas on the performance of the key players in construction projects. This research therefore focuses on examining the impact of skillfulness in utilizing the project management knowledge areas on the key players in construction projects. The study identifies the key players as the project owner or client, the consultant and the contractor. In addition, the project manager was added as part of the key players because of the key role they play for the contractor in the management of construction projects. This study is focused at finding the level of impact of skillfulness in the utilization of the project management knowledge areas contained in the PMBOK Guide on the performance of the client or project owner, consultant, contractor and the project manager in the management of construction projects

3. RESEARCH METHODS

This study adopted a quantitative research approach in which questionnaire was used for data collection. The most critical aspect of the research study was the identification of the variables and constructs used for data collection. In order to do this, an extensive review of literatures was conducted which resulted in the selection of the variables and constructs used for designing the questionnaire. Altogether, 70 variables and 12 constructs were identified and selected from Unegbu et al. (2020a & b) and the PMBOK Guide (PMI, 2017) and are labelled as shown in Table 1. This was followed by the development of the hypothetical model Figure 1 which was used for data analysis. The hypothetical model was developed after consultation and brainstorming with ten selected professionals in project management with not less than ten years of experience in the construction industry.

Table 1. The Key Players and Project Management Practices

S/N	Construct	Variables	Label
1.	Client (CLT)	Client's performance was positively impacted by project finance	Y31
2.		Client's performance was positively impacted by confidence in the project team	Y32
3.		Client's performance was positively impacted by the experience of construction project organization.	Y33
4.		Client's performance was positively impacted by response to the needs of other stakeholders	Y34
5.		Client's performance was positively impacted by demand and variation	Y35
6.		Client's performance was positively impacted by top management support	Y36
7.		Client's performance was positively impacted by the right award of bids.	Y37
8.		The nature of the client impacted his performance	Y38
9.	Consultant (CONS)	The performance of the consultant was positively impacted by his competence	Y41
10.		The performance of the consultant was positively impacted by adequate design details and specification	Y42
11.		The performance of the consultant was positively impacted by cooperation in solving problems among project stakeholders	Y43
12.		The performance of the consultant was positively impacted by the involvement of all stakeholders in minor issues	Y44
13.	Contractors (CONT)	The performance of the contractor was positively impacted by his competence	Y51
14.		The performance of the contractor was positively impacted by the implementation of effective safety programs	Y52
15.		The performance of the contractor was positively impacted by the implementation of effective quality assurance programs	Y53
16.		The performance of the contractor was positively impacted by the supervision of the work of the sub-contractors	Y54
17.		The performance of the contractor was positively impacted by the use of skilled workers	Y61
18.		The performance of the contractor was positively impacted by emphases on high quality workmanship	Y62

Table 1. The Key Players and Project Management Practices (continued)

19.		The performance of the contractor was positively impacted effective monitoring of budget	Y63
20.		The performance of the contractor was positively impacted by adequate site management	Y64
21.	Project Manager Related Factors (PM)	The performance of the project was positively impacted his experience	Y65
22.		The performance of the project manager was positively impacted by the adaptability of changes in the project plan	Y66
23.		The performance of the project manager was positively impacted by effective leadership and adequate authority	Y67
24.		The performance of the project manager was positively impacted by his early and continuous involvement in the project	Y68
25.	Scope Management (SM)	Scope management was positively impacted by scope management plan	X11
26.		Scope management was positively impacted by scope requirement collection	X12
27.		Clarity in scope definition positively impacted scope management	X13
28.		Scope validation positively impacted scope management	X14
29.		Alternative's identification positively impacted scope management	X15
30.		Work breakdown structure (WBS) positively impacted scope management	X16
31.		Analysis of variance positively impacted scope management	X17
32.	Time Management (TM)	Schedule planning positively impacted time management	X21
33.		Activities' definition positively impacted time management	X22
34.		Activities' sequencing positively impacted time management	X23
35.		Resource estimation for activities positively impacted time management	X24
36.		Activities' duration estimation positively impacted time management	X25
37.		Schedule development positively impacted time management	X26
38.		Schedule control positively impacted time management	X27
39.	Cost Management (CM)	Planning of cost positively impacted cost management	X31
40.		Estimation of project cost positively impacted cost management	X32
41.		Budget determination positively impacted cost management	X33
42.		Cost control positively impacted cost management	X34
43.	Management of Quality (QM)	Analysis of cost-benefit positively impacted quality management	X41
44.		Estimation of cost of quality positively impacted quality management	X42
45.		Utilization of cause-effect diagram positively impacted quality management	X43
46.		Utilization of the control chart positively impacted quality management	X44
47.		Quality assurance performance positively impacted quality management	X45
48.		Utilization of statistical sampling positively impacted quality management	X46
49.	Risk Management (RM)	Risk management plan development positively impacted risk management	X51
50.		Risk identification positively impacted risk management	X52
51.		Qualitative risk analysis positively impacted risk management	X53
52.		Quantitative risk analysis positively impacted risk management	X54
53.		Risk response planning positively impacted risk management	X55
54.		Risk control approaches positively impacted risk management	X56
55.	Communication Management (COM)	The technology used for communication positively impacted communication management	X71
56.		Analysis of communication requirements positively impacted communication management	X72
57.		The models and methods used for communication positively impacted communication management	X73
58.		Utilization of information communication system positively impacted communication management	X74
59.		Performance reports positively impacted communication management	X75
60.	Procurement Management (PROC)	Utilization of make-or-buy analysis positively impacted procurement management	X81
61.		Conduction of market research positively impacted procurement management	X82
62.		Evaluation of proposals positively impacted procurement management	X83

Table 1. The Key Players and Project Management Practices (continued)

63.		Performance of procurement review positively impacted procurement management	X84
64.		Conduction of inspection and audits positively impacted procurement management	X85
65.		The management of records and payment system positively impacted procurement management	X86
66.	Stakeholder Management (SKM)	Analysis of stakeholders positively impacted stakeholder management	X91
67.		Planning of stakeholder management and approaches positively impacted stakeholder management	X92
68.		Utilization of communication methods positively impacted stakeholder management	X93
69.		Interpersonal and management skills positively impacted stakeholder management	X94
70.		Utilization of information management system positively impacted stakeholder management	X95

This research involved 10 construction companies with at least five active projects in the North Central Zone of Nigeria. A sample size of 250 was selected from the population of these companies randomly using simple random sampling technique. The sampled professionals include 55 clients or project owners, 75 consultants, 90 contractor personnel and 30 project managers. All the project management professionals sampled have not less than ten years of experience in construction project management.

The questionnaire was divided into two parts for effective data collection. Section 1 was structured to collect data on the demography of the respondents while section 2 collected information on the identified variables for the key project players (client, consultant, contractor and project manager) and the project management knowledge areas used for the study. The respondents were requested to rate 70 identified variables on a five-point Likert scale in which 1 represents undecided, 2 represents strongly disagree, 3 represents disagree, 4 represents agree and 5 represents strongly agree. To ensure that a thorough work is done by the respondents, a representative was selected for each construction company and a sample of the questionnaire was filled with them under the guidance of the researcher. This sample was now used by them to guide others in their respective companies. In addition, the researchers deemed it important to ensure that the respondents understood the purpose of the questionnaire before response. This was done by attaching a cover letter to the front page of the questionnaire which explained the purpose of the research and the research objectives.

3.1 Hypothetical Model

The hypothetical SEM (Figure 1, see Appendix) was developed using the eight identified project management knowledge areas and the four identified key players in construction projects. The eight project management knowledge areas were used as independent latent constructs, while the key players were used as dependent latent constructs. For the sake of convenience of drawing, the observed or measured varies were not captured in the hypothetical model. The aim of the hypothetical SEM was to identify the impact of skillfulness in the project management knowledge areas on the performance of the key project players. The result of the brainstorming session with the 10 selected professionals managing construction projects is 28 hypotheses that showed positive impact of the project management knowledge areas on the key construction project players as shown below.

1 Time management positively influences the performance of the client.
2 Cost management positively impacts client's performance.
3 Quality management positively impacts client's performance.
4 Communication management positively impacts client's performance.
5 The project consultant positively impacts client's performance.
6 Scope management positively impacts the consultant's performance.
7 Cost management positively impacts the consultant's performance.
8 Quality management positively impacts the consultant's performance.
9 Communication management positively impacts the consultant's performance.
10 Stakeholder management positively impacts the consultant's performance.
11 Contractor positively impacts the consultant's performance.
12 Scope management positively impacts the performance of the contractor.
13 Quality management positively impacts the performance of the contractor.
14 Risk management positively impacts the performance of the contractor.
15 Communication management positively impacts the performance of the contractor.
16 Procurement management positively impacts the performance of the contractor.
17 Stakeholder management positively impacts the performance of the contractor.

18 The consultant positively impacts the performance of the contractor.
19 The project manager positively impacts the performance of the contractor.
20 Scope management positively impacts the performance of the project manager.
21 Time management positively impacts the performance of the project manager.
22 Cost management positively impacts the performance of the project manager.
23 Quality management positively impacts the performance of the project manager.
24 Risk management positively impacts the performance of the project manager.
25 Communication management positively impacts the performance of the project manager.
26 Procurement management positively impacts the performance of the project manager.
27 Stakeholder management positively impacts the performance of the project manager.
28 The consultant positively impacts the performance of the project manager.

3.2 Method of Data Analysis

Data analyses was carried out in Statistical Package for Social Sciences (SPSS), Microsoft Excel, and Linear Structural Relationship (LISREL). Firstly, the demography of the participants was analyzed using descriptive statistics in SPSS. Secondly, the number of variables utilized for subsequent analyses was reduced using exploratory factor analysis in SPSS in which the variables with factor loadings less than 0.6 were eliminated from the SEM (Unegbu Et al., 2020b). Thirdly, the data was analyzed for reliability and validity using the composite reliability test (CR), the Cronbach's alpha test and the average variance extracted (AVE) respectively. Values greater or equal to 0.6 was taken as acceptable for both the reliability and validity tests (Chou & Yang, 2012). Finally, the developed hypothetical model was tested in LISREL using SIMPLES syntax method as shown, and the model was modified and validated based on the values of six goodness of fit (GF) indices. The GF selected for the analysis which accounted for absolute fit, comparative fit and parsimony adjusted fit include the goodness of fit index (GFI)., the Chi Square-Degree of Freedom ratio, the comparative fit index (CFI), the non-normed fit index (NNFI) or Tucker Lewis index (TLI), the root mean square error of approximation (RMSEA) and the root mean square residue (RMSR). The cutoff value used for the GF indices were as stipulated by Karl et al. (2016).

SIMPLES Syntax

Raw Data from file 'C:MARIS SCHOOL.psf'
Latent Variables CLT CONS CONT PM TM SM CM RM QM
COM PROC SKM
Relationships
CLT = CM CONS COM QM TM
PM = CM RM COM TM PROC SKM QM CONS SM
CONS =SM QM CONT SKM COM CM
CONT =SM QM RM COM PROC SKM CONS PM
Y32 Y33 Y34 Y35 Y37 =CLT
Y41 Y43 Y44 =PM
Y51-Y54 =CONS
Y61 Y64 Y65 Y66 Y68 =CONT
X13-X16 =SM
X21 X22 X23 X26 X27 =TM
X31 X32 X33 X34 =CM
X41 X42 X43 X44 =QM
X51 X52 X55 X56 =RM
X72 X73 X74 X75 =COM
X81 X82 X84 X85 X86 =PROC
X91 X92 X94 X95 =SKM

4. RESULTS AND DISCUSSION

4.1 Responses

Out of the 250 questionnaires a total of 213 valid responses were utilized for the data analysis which indicates 85% response rate. 57% of the respondents were Civil and Structural Engineers and the mean work experience of the respondents is 5 years as recommended by Hwang and Lim (2013).

4.2 Preliminary Data Analysis

The result of the exploratory factor analysis which was carried out to reduce the number of variables used for the SEM is shown in Table 2. From the 70 identified variables, 18 were eliminated with factor loadings less than 0.6. This resulted in 52 observed or manifest variables being used to measure the 12 latent variables used in the hypothetical SEM with each construct being measured by at least three observed or manifest variables. The reliability and validity tests were acceptable for all the latent variables (Table 3) with values greater or equal to 0.6 as recommended by Karl et al. (2016).

Table 2. Exploratory Factor Analysis

S/N	Variable	Factor Loading
1.	Y31	0.551
2.	Y32	0.718
3.	Y33	0.674
4.	Y34	0.679
5.	Y35	0.71
6.	Y36	0.443
7.	Y37	0.716
8.	Y38	0.456
9.	Y41	0.62
10.	Y42	0.496
11.	Y43	0.71
12.	Y44	0.715
13.	Y51	0.704
14.	Y52	0.707
15.	Y53	0.649

Table 2. Exploratory Factor Analysis (continued)

16.	Y54	0.622
17.	Y61	0.716
18.	Y62	0.362
19.	Y63	0.465
20.	Y64	0.752
21.	Y65	0.768
22.	Y66	0.683
23.	Y67	0.548
24.	Y68	0.701
25.	X11	0.445
26.	X12	0.423
27.	X13	0.681
28.	X14	0.696
29.	X15	0.709
30.	X16	0.701
31.	X17	0.588
32.	X21	0.737
33.	X22	0.755
34.	X23	0.699
35.	X24	0.545
36.	X25	0.453
37.	X26	0.733
38.	X27	0.74
39.	X31	0.719
40.	X32	0.67
41.	X33	0.637
42.	X34	0.733
43.	X41	0.76
44.	X42	0.682
45.	X43	0.732
46.	X44	0.78
47.	X45	0.535
48.	X46	0.463
49.	X51	0.718
50.	X52	0.723
51.	X53	0.555
52.	X54	0.439
53.	X55	0.716
54.	X56	0.759
55.	X71	0.487
56.	X72	0.759
57.	X73	0.782
58.	X74	0.741
59.	X75	0.822
60.	X81	0.812
61.	X82	0.705
62.	X83	0.439
63.	X84	0.734
64.	X85	0.756
65.	X86	0.69
66.	X91	0.682
67.	X92	0.724
68.	X93	0.668
69.	X94	0.682
70.	X95	0.717

Table 3. Validity and Reliability tests

SN	CONSTRUCT	(a)	AVE	CR
1	Client related factors (CLT)	0.863	0.703	0.609
2	Consultant related factors (CONS)	0.777	0.703	0.6825
3	Contractor related factors (CONT)	0.905	0.751	0.863
4	Project Manager (PM)	0.780	0.608	0.7602
5	Management of scope (SM)	0.768	0.516	0.8793
6	Management of time (TM)	0.855	0.520	0.8836
7	Management of cost (CM)	0.855	0.503	0.8609
8	Management of quality (QM)	0.839	0.508	0.8602
9	Management of risk (RM)	0.877	0.603	0.8825
10	Management of communication (COM)	0.859	0.584	0.8752
11	Management of procurement (PROC)	0.856	0.528	0.8694
12	Management of stakeholders (SKM)	0.807	0.620	0.8905

4.3 Testing of the Hypothetical SEM

The result of the testing of the hypothetical SEM is shown in Figure 2. Although the result of the experimental model was acceptable based on the GF statistics, further refinement was carried out by removing the paths SKM-CONT, SKM-CONS, PROC-PM and SM-CONT to arrive at the modified SEM (Figure 3) resulting in a better GF statistic (Table 4) based on the recommendation of Karl et al. (2016), Kline (2005) and Chou and Yang (2013). The accepted and rejected hypotheses alongside their path coefficients are shown in Table 5.

Table 4. Goodness of Fit Statistics

SN	GF	Initial SEM	Modified SEM
1	GFI	0.67	0.74
2	X^2/df	2.6	2.3
3	CFI	0.644	0.84
4	NNFI or TLI	0.61	0.81
5	SRMSR	0.073	0.064
6	RMEA	0.085	0.08

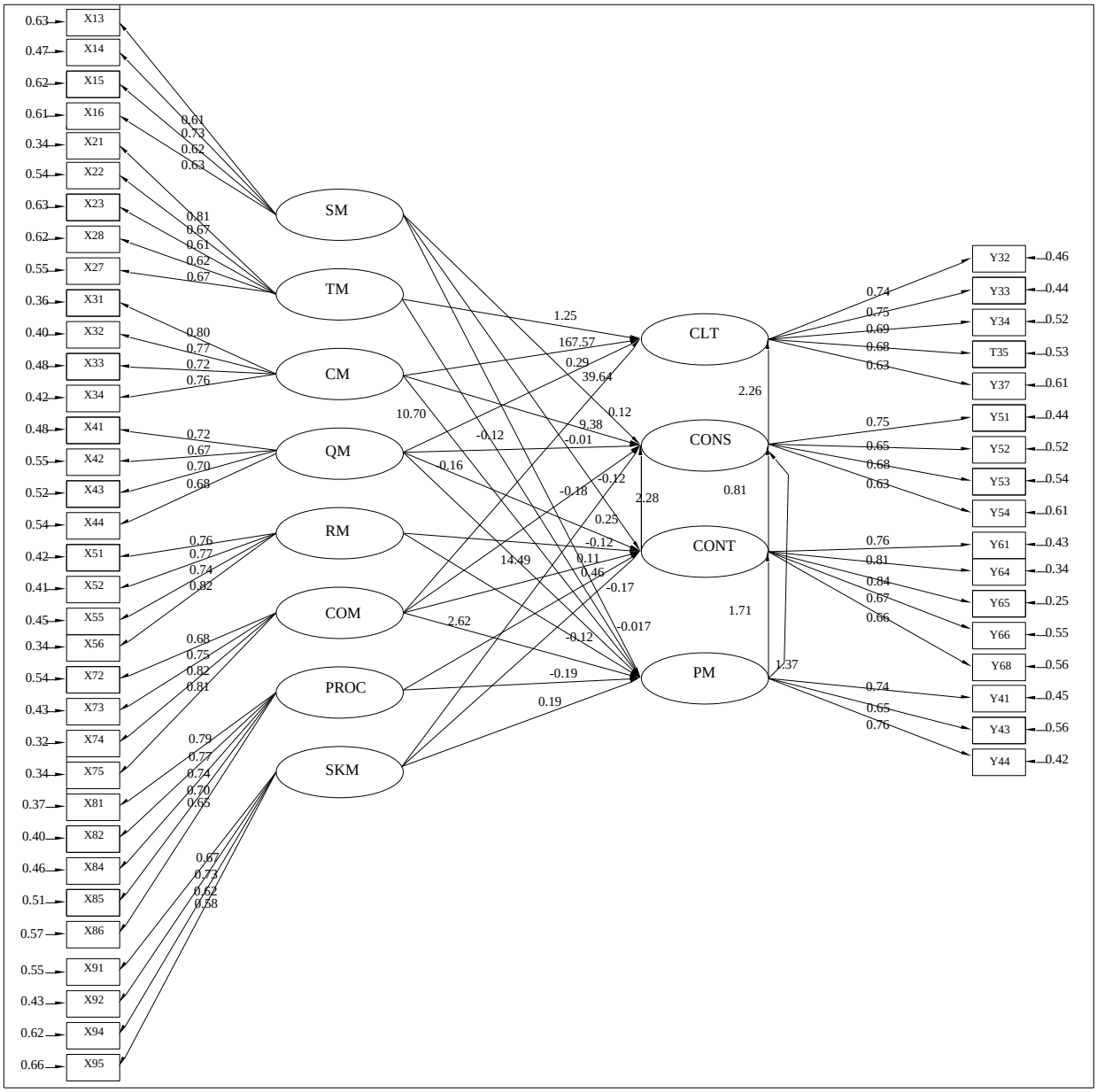

Figure 2. Initial SEM

4.4 The Impact of the Project Management Knowledge Area on the Client

The first four hypotheses focused on the impact of the project management knowledge areas on the performance of the client. All the four hypotheses (H1-H4) were validated with the strongest impact existing between quality management (H3) and the client with a path coefficient of 199.66. This was followed closely by the impact of cost management on the client (H2) with a path coefficient of 167.87. This implies that the knowledge of quality and cost managements highly impact the project performance of the client and as such should be paramount to them since they provide the project fund and are directly impacted by the quality of the project outputs. It also indicates the need for the project contractor and project manager to pay more attention to quality and communication management in

order to satisfy the client's expectations. The impact of time and communication managements knowledge areas (H1 & H4) on the client's performance in the management of construction projects were also significant with path coefficients of 4.21 and 39.64 respectively. This emphasizes the need for effective communication and time management throughout the lifecycle of a construction project. As pointed out by Unegbu et al. (2021), communication management is at the center of the rest of the project management knowledge areas since it positively impacts their performance. It was also discovered that the client's performance was influenced by the performance of the consultant (H5). It then means that the effectiveness of the consultant in managing construction projects will no doubt improve the performance of the client. Thus, the project management knowledge areas positively impact the project performance of the client.

4.5 The Impact of the Project Management Knowledge Areas on the Consultant

Out of the six hypotheses (H6-H11) used to assess the impact of the project management knowledge area on the performance of the consultant in the management of construction projects, four were validated and two were rejected. The validated hypotheses (H7 and H9) are that scope management, cost management and communication management positively impact the performance of the consultant. In addition, the hypothesis that the performance of the contractor positively impacts the consultant was validated. The strongest of these relationships exist between communication management and the consultant with a path coefficient of 10.7, which further points to the criticality of communication management in project management. This was followed by the impact of cost management on the consultant with a path coefficient of 9.38. This implies that the stillness of the project consultant in the usage of cost and communication management tools, techniques and methods as stipulated in the PMBOK Guide are the key determinants of their effectiveness in project management. Hypotheses H6, H8, H10 and H11 were rejected because of poor path coefficients.

4.6 The Impact of the Project Management Knowledge Areas on the Contractor

Since the contractor is the main executor of construction projects, eight hypotheses (H12-H19) were used to assess the impact of the project management knowledge areas on their performance in managing construction projects. Six of these hypotheses were validated (H12, H16-H19) while remaining (H13 and H14) two were rejected based on poor path coefficients. The validated hypotheses are that quality management, risk management, communication management and procurement management positively impact the project performance of the project contractor. In addition, it was found that both the consultant and the project manager's performance also have positive impact on the contractor. Though the path coefficients for these relationships are small compared to the previous ones, their level of significance and distribution are highly significant and acceptable. Thus, an improved mastery of the project management tools, methods and techniques by the contractor will enhance their effectiveness in managing construction projects.

4.7 The Impact of the Project Management Knowledge Areas on the Project Manager

In project management, the project manager is viewed as the key personnel of the contractor who is responsible for the project and maintains leadership over the project team. The project manager exercises authority over the project and accounts for its success or failure. Based on this, nine hypotheses (H20-H29) were used to test the impact of the project management knowledge areas on the project manager's performance. Eight of these were validated (H20-H25 and H27) which are that scope management, time management, cost management, quality management, risk management, communication management and stakeholder management positively impacts the performance of the project manager. In other words, the performance of the project manager depends highly on his mastery of the tools, techniques and methods in almost all the knowledge areas. In addition, the impact of the contractor on the project manager was also found to be significant and validated. This is to be expected since the project manager needs the support of the contractor in order to succeed in the project. The strongest relationship exists between quality management knowledge area and the project manager with a path coefficient of 12.49. This could be interpreted that the performance of the project manager depends to a large extent on the ability to deliver on quality which is key determinant of project success. The only rejected hypothesis is that procurement management positively impacts the project manager. This is valid given that the responsibility of procurement management to a great extent rest on the contractor (PMI,2017) who may assign a procurement personnel over it. Thus, skillfulness in the project management knowledge areas positively impacts the performance of the project manager in managing construction projects.

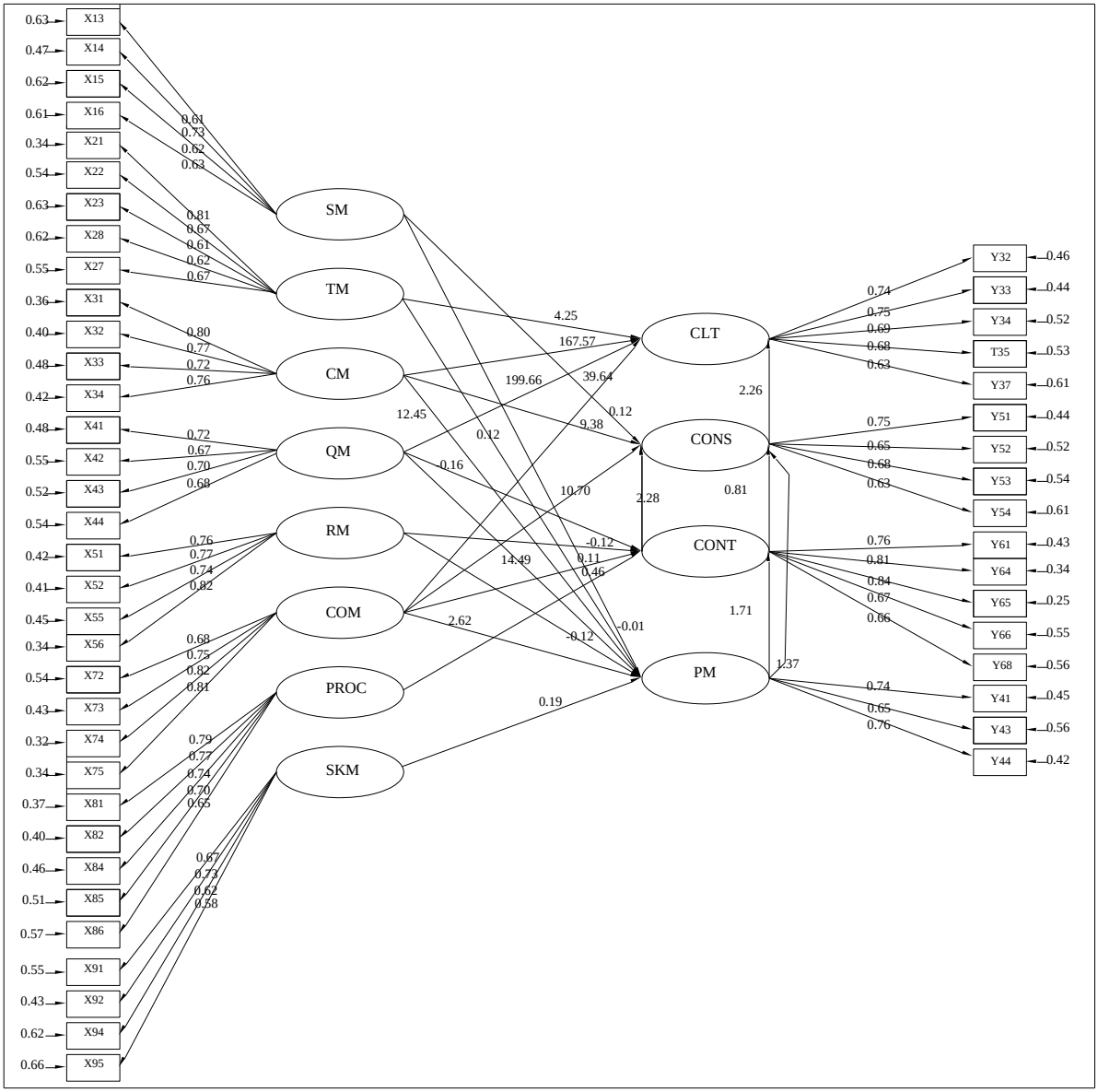

Figure 3. The Modified SEM

Table 5. Validated Relationships

Hypotheses	Key Player	Validated	Rejected	Path Coefficient
1.	Client or Project Owner	Yes		4.21
2.		Yes		167.87
3.		Yes		199.66
4.		Yes		39.64
5.		Yes		2.26
6.	Consultant		Yes	0.12
7.		Yes		9.38
8.			Yes	-0.01
9.		Yes		10.7
10.			Yes	-0.001
11.		Yes		0.84
12.	Contractor	Yes		0.253
13.			Yes	-0.18
14.				0.11
15.			Yes	0.11
16.		Yes		0.46
17.		Yes		0.17
18.		Yes		2.28
19.		Yes		1.71

Table 5. Validated Relationships (continued)

20.	Project Manager	Yes		-0.015
21.		Yes		0.12
22.		Yes		10.7
23.		Yes		12.49
24.		Yes		0.12
25.		Yes		2.62
26.			Yes	-0.19
27.		Yes		0.19
28.		Yes		1.37

4. CONCLUSION

This research study has assessed the impact of the project management knowledge areas on the performance of the key players in the management of a construction project. Based on literature review, a hypothetical structural equation model (SEM) was developed consisting of twenty-nine hypotheses. After using exploratory factor analyses to minimize the number of variables used for the SEM model, the experimental SEM model was obtained which was refined to improve the goodness of fit statistics. The relationships were then validated using the strength of their path coefficients. Out of these twenty-nine hypotheses used for the analyses, twenty-three were accepted having path coefficients greater or equal to 0.1, while six were rejected with path coefficients less than 0.1.

The strongest relationship exists between the client and quality management, the client and cost management, and the client and communication management with a path coefficient of 199.66, 167.87 and 39.64 respectively. Thus, emphasizing the importance of carrying the client along throughout the project's lifecycle. These were followed by the relationship between the project manager and quality management, the consultant and communication management, and the client and time management with path coefficients 12.49, 9.39 and 4.21 respectively. The result also indicates the need for an improved harmonious relationship among the key players as shown by the positive impact of the performance of the consultant on the client' performance, the performance of the contractor on the project manager's performance and the performance of the contractor on the consultant's performance, hence, the need for a high level of collaboration and cooperation.

The result of this study confirms that skillfulness in the application of the tools, techniques and methods contained in the project management knowledge areas as stipulated in the PMBOK Guide positively impacts the performance of the client, the consultant, the contractor and the project manager in managing construction projects. Thus, the need for the key players in construction projects to be well knowledgeable and trained in their utilization in order to improve their performance in construction projects. This also points to the fact that you cannot claim to be a project management professional without acquiring the necessary skills and certifications. It will therefore be a good practice for regulators in the construction industry to ensure compliance to this by all professionals in the industry.

The result also shows that the activities of the consultant positively impact the client, the contractor's activities positively impact the project manager and the consultant's activities positively impact the contractor and vice versa. Thus, the need to regularly expose the key players to project management practices through trainings and certifications as the case may be and the need for more harmonious working relationship among them when managing project for improved effectiveness and efficiency.

This research was carried out for the key players involved in the construction project management in Nigeria, a developing country. As such the research findings may only apply to countries with similar economic, political and socio-cultural background. This implies that the findings of this study may not be applied to developed countries. Similar studies are therefore recommended to be carried out in countries with diverse economic, political and socio-cultural background (developed countries) and comparisons be made with this study. A further study in the subject matter is recommended to focus on the impact of the project management knowledge areas on a broader perspective of key players in construction projects such as the government's regulatory agencies and the end users of the project.

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References:

Alwaly, K. A., & Alawi, N.A. (2020). Factors Affecting the Application of Project Management Knowledge Guide (PMBOK® GUIDE) in Construction Projects in Yemen. *International Journal of Construction Engineering and Management*, *9*(3), 81-91.

Association for Project Management (APM). (2016). *APM body of knowledge 6th Edition*. Buckinghamshire, UK: Association for Project Management.

Chou, J.-S., & Yang, J.-G., (2012). Project management knowledge and effects on construction project outcomes: An empirical study. *Project Management Journal*, *43*(5), 47-67.

Chua, D. K. H., Kog, Y. C. & Loh, P. K. (1999). Critical success Factors for different project objectives. *Journal of Construction Engineering and Management*, *125*(3), 142-150.

CIOB (2016). *Code of Practice for Programme Management in the Built Environment*. Chichester: Wiley Blackwell.

Consultancy.uk (2018). *Career: What is a consultant?* Retrieved from https://www.consultancy.uk/career/what-is-a-consultant (on 11 September 2018)

Farmer, M. (2016). *The Farmer Review of the UK Construction Labour Model*. London: Construction Leadership Council (CLC).

Hwang, B. & Lim, E. J. (2013). Critical Success Factors for Key Project Players and Objectives: Case Study of Singapore. *Journal of Construction Engineering and Management*, *139*(2), 2204-215.

International Project Management Association, IPMA Individual Competence Baseline Version 4.0, (2015).

Isik, Z., Arditi, D., Dikmen, I., & Birgonul, M. T. (2008). Impact of corporate strengths/weaknesses on project management competencies. *International Journal of Project Management*, *27*(6), 629-637.

Jeremiah, M., & Kabeyi, B. (2019). Evolution of Project Management, Monitoring and Evaluation, with Historical Events and Projects that Have Shaped the Development of Project Management as a Profession. *International Journal of Science and Research (IJSR)*, *8*(12):63-79

Jin, X., Zhang, G., LiuYingbin, J. & Zu, F. (2017). Major Participants in the Construction Industry and Their Approaches to Risks: a Theoretical Framework. *Procedia Engineering*, *182*(2017), 314-320.

Kerzner, H. (2003). *Project management, a systems approach to planning, scheduling and controlling*. New York: John Wiley and Sons.

Kog, Y.C., & Loh, P. K., (2012). Critical success factors for different components of construction projects. *Journal of Construction Engineering and Management*, *138*(4), 520-528.

Prabhakar, G.P. (2008). Projects and their management: a literature review. *International Journal of Business and Management*, *3*(8), 2-4.

Project Management Institute, (2017). *A Guide to the Project Management Body of Knowledge (PMBOK)*, 5th Edition.

Unegbu, H. C. O., Yawas, D. S. & Dan-asabe, B. (2020a). An investigation of the Relationship between Project Performance Measures and Project Management Practices of Construction Projects for the Construction industry in Nigeria. *Journal of King Saud University - Engineering Sciences*; 1-10. doi: https://doi.org/10.1016/j.jksues.2020.10.001

Unegbu, H. C. O., Yawas, D. S., & Dan-asabe, B. (2020b). Structural Equation Model of the Relationship between Project Performance Measures and the Critical Success Factors of Construction Projects: A Case of the Nigerian Construction Industry. *Jurnal Mekanikal*, *43*, 33-51.

Unegbu, H. C. O., Yawas, D. S. & Dan-asabe, B. (2021). Assessment of the Relative Importance and Relationships of Project Management Practices for the Construction Industry in Nigeria. *Proceedings on Engineering Sciences*, *3*(1), 65-80.

Zwikael, O. (2009). The Relative Importance of the PMBOK® Guide's Nine Knowledge Areas during Project Planning. *Project Management Journal*, *40*(4), 94-103.

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Appendix

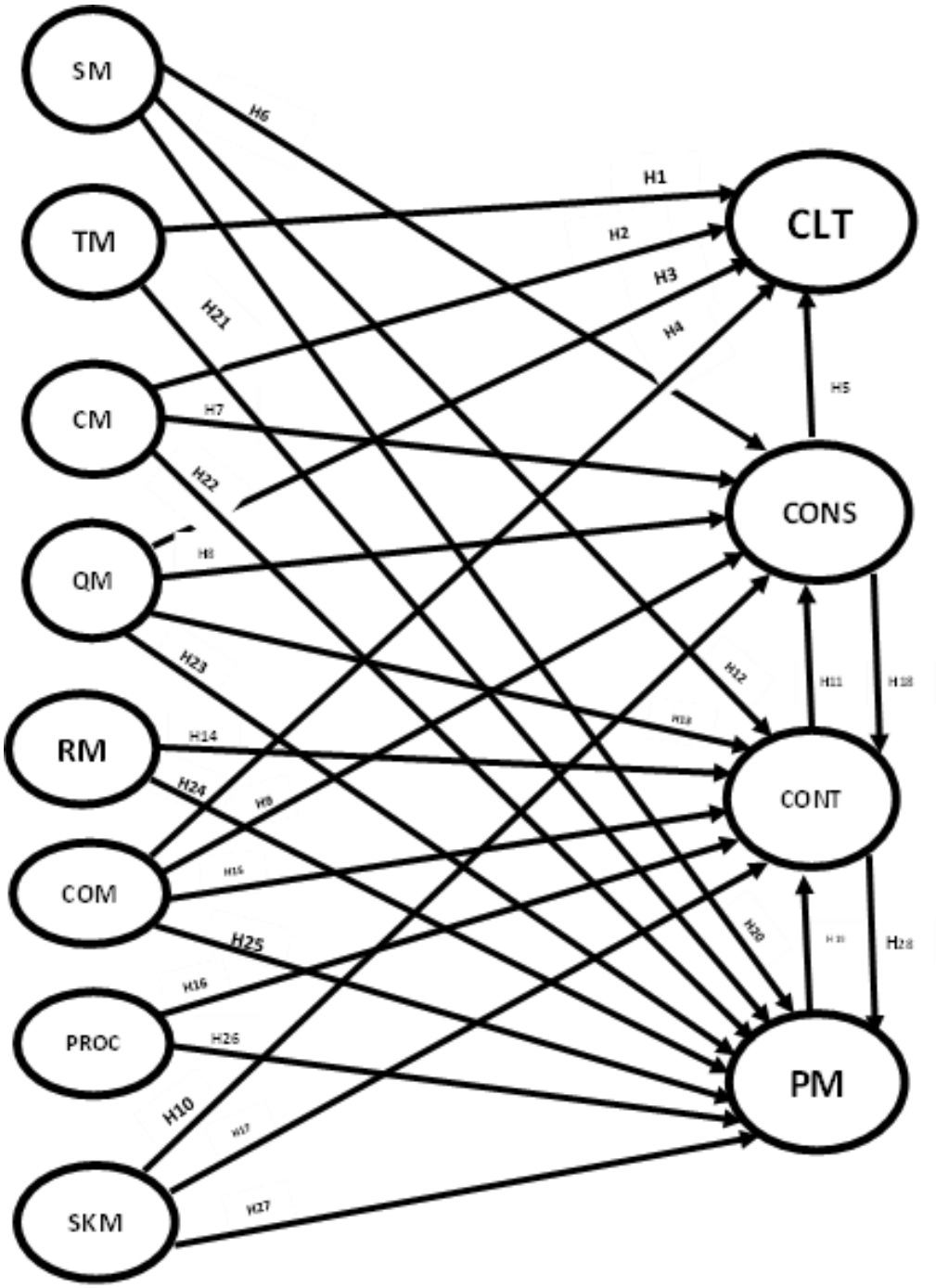

Figure 1. Hypothetical SEM Model