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To cite this article: Ibrahim Ibrahim Inuwa *et al* 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **513** 012002

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Effects of craftsmen supervisors project management skills on construction project success in Nigeria

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Abstract. In Nigeria there is shortage of competent craftsmen due to project management skills (PMS) deficiency in their quality of training. This study investigates the effect of craftsmen supervisors PMS on construction project success in Nigeria, with a view to improving on craftsmen supervisors' productivity. Disproportionate stratified random sampling technique was used to administer 132 questionnaires to project managers (PM). Data were analysed using descriptive and inferential statistics. Result shows that craftsmen supervisors PMS requirements are relevant and positively relates to construction project success. This implied that PMS can improve craftsmen supervisors productivity, as well as bridge the gap between project management approach (PMA) and construction operations execution. The skills will as well enhanced construction supervision and operations productivity to attain project success. Hence the study recommends PMS to be integrated in craftsmen supervisors training in Nigeria.

1. Introduction

Monuments such as Angkor temples of Cambodia, the giant course way of Ireland, the Great Wall of China, and the pyramids of Giza show results of PMA in the technical competence of craftsmen supervisors in managing the construction operations [1] [2] [3] [4]. Craftsmen are contractors operatives who contribute skilfully with their hands in the practical realization of a construction project, while craftsmen supervisors are experience construction craftsmen that have been upgraded to line managers and authorized to directly manage other craftsmen operations while reporting to a higher ranking manager on the activities on construction site [5] [6]. Ness [7] draws the attention of the construction industry on neglect of the huge reservoir of practical, experiential and tacit knowledge for the advancement of its craftsmen to managerial position. Chindo *et al.* [8] observed that the absence of a framework for skills training in construction is one of the major challenges in the training of craftsmen in the Nigerian construction industry (NCI). Usman *et al.* [6] asserted that periodic training of construction craftsmen is a pre-requisite for improving on their productivity.

According to Kerzner [5], construction craftsmen supervisors (line managers) must understand the principle of project management since they are responsible for recruiting operatives, dispatching tasks to operatives, as well as responsible for overseeing operatives activities in a project. Thus, Kerzner [5] stressed that understanding the principles of project management is a necessity for craftsmen supervisors to provide visible support and commitment for the construction process. However, in



Nigeria, craftsmen training has been inadequate and declined to 42% [9]. Moreover, the few craftsmen trained lacked quality craftsmanship that match the demand of the construction industry [10]. This trend resulted in the inability of the craftsmen to keep abreast with the technological development in the NCI [11] [12]. A review of studies conducted on craftsmen training in the NCI fall short of identifying PMS requirements for the training of craftsmen, and the effect of craftsmen PMS on construction project success (see: [13] [14] [8] [11] [6] [12] [8] [10]). Likewise, a review of the curricula use by craftsmen training institutions in Nigeria are deficient of PMS integration in their training modules [15] [16] [17]. Hence this study investigates the effect of craftsmen supervisors PMS on construction project success in Abuja, Nigeria, with a view to improving on craftsmen supervisors productivity. To achieve its aim the following objectives were outlined: to identify and assess craftsmen supervisors PMS requirements, and to determine the relationship of craftsmen supervisors PMS and construction project success

2. Literature review

2.1. Theoretical construct

This study adopted project management theory (PMT) propounded by Koskela and Howell [18]. Project management is the art of directing and coordinating human and material resources through the life of a project by using modern management techniques to achieve pre-determined goals of scope, cost, time, quality and participant satisfaction [1]. Koskela and Howell [18] sub divided PMT into: theory of project and theory of management (see Table 1). The theory of project have three concepts: transformation, flow, and value (TFV). While the theory of management comprised of three models: planning, execution, and control [19].

Table 1. Project management theoretical constructs [19].

Subject of Theory		Concepts in Theory
1. Project		Transformation
		Flow
		Value generation
2. Management	Planning	Management-as-planning
		Management-as-organizing
		Classical communication theory
	Execution	Language/action perspective
		Thermostat model
	Control	Scientific experimentation model

2.1.1. Theory of project

i. Transformation

Transformation is concern with how inputs are converted into output [20]. This enables a project to be realize in an optimal manner and tasks executed in an optimal sequence through identification of the various tasks involve and their sequential relationship, curtailing uncertainty on requirements and tasks, and efficient project resource scheduling [19]. Transformation process portrays an overview of the operational structure of the project, thus provides management with the technical basis for answers to economic, time-scheduling, quality, quantity and organization questions [21].

ii. Flow

The flow concept is about eliminating non-value adding activities and integrating value adding activities throughout the transformation process [22]. Flow is achieved through the improvement of project lead time, variability reduction, flexibility, and transparency [22]. Thus, the flow concept in construction is contextualized into: adding and non-value adding activities, even flow, variability, and preconditions to work tasks in construction (see [22]).

iii. Value

The value concept is concern with how to integrate customer/end user requirements in the design and construction process of a construction project [22]. Thus, the concept of value in project management requires a manager to integrate customer/end-user optimum requirements in their construction design and execution; it takes into cognizance the project inputs, tasks, and sequence of operations throughout the transformation path [20].

2.1.2. Theory of management

i. Theory of planning

The theory of planning is subdivided into: management-as-planning and management-as-organizing. Management-as-planning theorized that planning a project has a managerial part and an effector part [18]; managerial part focus on creation and revision of plan (planning), while the effector part is the implementation of the resultant plan. Management-as-organizing optimally aimed at assembling the necessary resources into a cohesive structure in accordance with the project plan requirements [23].

ii. Theory of execution

The theory of execution is modelled into: dispatching model, and the language/action perspective model. The dispatching model conceptualized that, managerially, execution is about assigning (dispatching) tasks to work stations and, this is regarded as the classical communication theory [19]. Classical communication model focus on passing instructions to operatives without considering their effective understanding of the instructions passed. The short comings of the classical communication theory is complemented with the language/action perspective model, which emphasize a two-way communication and commitment, instead of the mere one-way communication [19]. Thus, communication of tasks dispatched to work stations must be comprehensive to the operatives; they should be feedback mechanisms that will convey the operatives understanding of the instruction passed.

iii. Theory of control

The theory of control consist of: thermostat model and the scientific experimental model (Koskela & Howell 2002a). Thermostat model conceptualized that in the project production process, there is a process to control, a unit for performance measurement, a standard of performance, and a controlling unit [19]. The model enables a production process to be monitored and controlled (Inuwa 2014). While the scientific experimental model focus on studying the causes of deviation in project production performance in order to proffer solution [19].

2.2. Craftsmen supervisors PMS requirements

A skill is the ability to do something well; expertise [24]. PMS for craftsmen supervisors are skills that give craftsmen supervisors the optimal ability to carry out their supervisory task in line with construction project management processes [10]. PMS requirements for craftsmen supervisors can be acquired through the application of project management's knowledge, skills, and techniques [1]. Training craftsmen supervisors on the application of project management entails giving them teaching and practices on the application of project management in order to bring them to the desired standard of behaviour, efficiency or physical condition for optimal realization of their supervisory role in the execution of construction project [25]. This study explore PMT to identify craftsmen supervisors PMS requirements. The project transformation process informs project manager of the overview of the operational structure of the project, thus provides management with the technical basis for answers to economic, time-scheduling, quality, quantity and organization questions. These subsequently guide the acquisition of skills on: design comprehension, resource scheduling, time scheduling, tasks execution effectiveness, and tasks execution effectiveness enhancing [21] [19]. The project flow concept is achieved through the display of skills that enable adequate resource organization, timely project

completion, and adequate pre-activity identification. Thus, informs the development of construction craftsmen supervisors skills on: optimal workmanship attainment, task execution effectiveness, and task preconditions identification [22]. The value concept entails managers to optimize workmanship that ensures meeting the value requirement of the project stakeholders [1]. Hence craftsmen supervisors need skills on optimal workmanship attainment. Understanding the concept of planning in the theory of management enables craftsmen supervisors acquire skills on: task execution planning, task execution implementation, and task execution management [23] [18] [22]. The theory of execution enhances the craftsmen supervisors communication skill in dispatching tasks to work stations [20]. While the theory of control enhances craftsmen supervisors skill on how to monitor and control the performance of operatives in the construction project production process [20].

2.3. Relationship of craftsmen supervisors PMS and construction project success

Kerzner [5] acknowledged that PMA allows the arrangement of work flow and project coordination horizontally and vertically, thus resulting in extensive planning and coordination. Moreover the PMA enables work to be organized across the various functional groups that work with each other. This results in improved coordination and communication among employees and managers, as well as in project success through high level productivity, efficiency, and effectiveness [5]. Though several studies have given different approach to what constitute success of a project [5] [26]. Kerzner [5] reported that the success of a project entails meeting budget, timeliness, ensuring quality performance, and meeting customers' satisfaction. Besides [5], other factors that constitute project success are environmental and safety regulations, and delivering the productivity for the manufacturing operations. Khosravi and Afshari [26], identified the following as project success criteria: time performance, cost performance, quality performance, health, safety and environment of the project, and client satisfaction. Thus, this study adopted the project success criteria reported by Kerzner [5], and Khosravi and Afshari [26] to determine the effects of craftsmen supervisors PMS on construction project success. The success criteria are: project cost effectiveness (PCE), attainment of project timeliness (APT), attainment of quality workmanship (AQW), achieving customers/end users requirements (ACEUR), adherence to project specifications (APS), curtailing construction materials waste (CCMW), curtailing construction site accidents (CCSA), ensuring environmental friendliness (EEF), project quality attainment (PQA), less/absence of construction project rework (LACPR), and smooth construction activities execution and integration (SCAEI).

3. Methodology

3.1. Questionnaire design and administration

This study used the three higher levels of cognitive domain of Bloom's revised taxonomy of educational objectives (analysing, evaluating & creating) (see [27] to review PMT propounded by Koskela and Howell [18] in identifying craftsmen supervisors PMS requirements, and other relevant literature to identify construction project success factors in relation to craftsmen supervisors PMS. Subsequently, designed a questionnaire to collect data on: respondents' demographic profile, craftsmen supervisors PMS requirements, and project success in relation to craftsmen supervisors PMS. PM and seasoned academicians in construction project management were used to pre-test the questionnaire. Internal consistency testing of the questionnaire using Cronbach alpha record 0.84, 0.83, and 0.83 reliability values for respondents' profiles, relevance of craftsmen supervisors PMS, and effects of craftsmen supervisors PMS on construction project success respectively. These portray the questionnaire to be reliable and error free [28]. Likert scales of 1-5 were used to assess the two study construct on the: relevance of craftsmen supervisors PMS requirements, and the effects of craftsmen supervisors PMS on construction project success. The scale interpretation for relevance of PMS are: 1-irrelevant, 2-least relevant, 3-fairly relevant, 4-relevant, and 5-very relevant. While the scale for construction project success are: 1-ineffective, 2-least effective, 3-moderately effective, 4-effective, and 5-highly effective. The study population is heterogeneous comprising of 200 accessible

construction professionals that are statutorily certified by the Nigerian government to practice project management: architects, builders, engineers, and quantity surveyors [29]. These set of professionals conform to Chitkara's [3] recommendation that construction PM should be persons with at least a degree or its equivalent in engineering, architecture, and quantity surveying. A sample size of 132 PM was established using Krejcie and Morgan [30] table. Hence 132 questionnaires were administered to the respondents using disproportionate stratified random sampling technique. The heterogeneous nature and the uneven distribution of the study population informs the adoption of disproportionate stratified random sampling technique. The survey was conducted in Abuja the administrative capital of Nigeria because it has the highest concentration of experience construction PM [31] [32]. The survey records 44% (58) valid response rate: architects (arc) (14), builders (bldr) (9), engineers (enr) (25), and quantity surveyors (qs) (10). Respondents are from the public (83.8%) and private (16.2%) sectors of the Nigerian economy respectively. This reflect the divides in the Nigerian economy which is a mix economy (Inuwa, 2014).

3.2. Method of data analysis

Data from the survey were analysed using statistical package for social sciences (SPSS). Percentages and frequencies were used to analyse respondents' profile, while mean scores were used to rank craftsmen supervisors PMS requirements identified. ANOVA with post hoc and Spearman's rank order correlation coefficient were used to test hypotheses mirroring the study objectives, and to determine the relationship of craftsmen supervisors PMS requirement and project success respectively.

4. Results and discussions

4.1. Respondents profiles

Respondents' educational qualifications are: certificate (1.7%), HND (15.5%), PGD (19%), BSc/B.Tech (25.9%), MSc (36.2%), and PhD (1.7%). Despite being certified as PM, their core construction disciplines are rooted either in architecture (24.1%), building (15%), engineering (43.1%), or quantity surveying (17.2%). About 98% of the respondents hold managerial positions in their respective organisations: top management (47%), middle management (28%), lower management (22.4%), and supervisory staff (line managers) (2%). Respondents have an average of 15 years' experience in the construction industry. These results revealed that most of the respondents' are core construction PM that are qualified and experience to respond to an enquiry of this nature and as such, assist the study in ensuring that all the variables that have an influence on the correctness of the data have been analysed. By implication, this ensures that the respondents used for the study are the most appropriate sample [28] [3].

4.2. Craftsmen PMS requirements

Table 2 depicts responses on craftsmen supervisors PMS requirements and their level of significance using ANOVA with post hoc at 95% confidence level. Design comprehension skill (DCS) was ranked very relevant (4.33-4.50) by all the respondents. Total mean ($T\bar{X}$) of the respondents ranked DCS relevant (4.47). Optimal workmanship attaining skill (OWAS) was ranked by all respondents but 'qs' as relevant (4.21-4.40). Quantity surveyors ranked OWAS very relevant (4.80). However OWAS was averaged by all the respondents as relevant (4.36). Task dispatching communication skill (TDCS) was ranked relevant (4.20-4.40), with the respondents $T\bar{X}$ of 4.22 showing it to be relevant. Task execution effectiveness enhancing skill (TEEES) ranked relevant (3.89-4.40) by all the respondent which also corresponds with their $T\bar{X}$ (4.26) as relevant. Task execution implementation skill (TEIS) ranked relevant (3.92-4.07) by all respondents, as well as their total mean ($T\bar{X}$ =3.98). The individual groups ranking on task execution monitoring skill, task execution planning skill, task precondition identification skill, task resource organizing skill and task resource scheduling skills were relevant PMS requirement for craftsmen supervisors training respectively (see table 1). The ANOVA in table 2 shows that there is no statistical significant difference in the mean ranking of respondents on the PMS

requirement. Their p value exceed 0.05 ($p > 0.05$), thus the null hypothesis that there is no statistically significant difference in the respondents mean ranking on PMS requirements for craftsmen supervisors training was accepted. The PMS identified assists craftsmen supervisors in the planning, organising, monitoring and controlling of all aspects of their supervisory role in a construction project as well as, sharpened their motivational skills on their subjects to improve productivity that results in achieving construction project success. Skills identified are in conformity with the factors identified by Alinaitwe *et al.* [33], John *et al.* [10], and Tunji-Olayeni *et al.* [34] as necessary for enhancing construction craftsmen productivity. However their studies were not focused on identifying craftsmen supervisors PMS requirements.

Table 2. Responses on PMS requirements for craftsmen supervisors training.

S/N	PMS	Respondents mean scores					SD	F	Sig.	LS
		arc	bldr	enr	qs	$T\bar{X}$				
1	Design comprehension skill	4.50	4.33	4.48	4.50	4.47	0.60	0.17	0.92	NS
2	Optimal workmanship attaining skill	4.21	4.00	4.40	4.80	4.36	0.72	0.39	0.08	NS
3	Task dispatching communication skill	4.29	4.00	4.20	4.40	4.22	0.84	0.38	0.77	NS
4	Task execution effectiveness enhancing skill	4.21	3.89	4.36	4.40	4.26	0.81	0.87	0.46	NS
5	Task execution implementation skill	4.07	4.00	3.92	4.00	3.98	0.93	0.08	0.97	NS
6	Task execution monitoring skill	4.29	3.89	3.72	4.50	4.02	0.96	2.17	0.10	NS
7	Task execution management skill	4.00	3.89	4.00	4.40	4.05	0.91	0.62	0.61	NS
8	Task execution planning skill	3.86	3.67	3.84	4.00	3.84	0.91	0.20	0.89	NS
9	Task precondition identification skill	3.79	3.56	4.08	4.10	3.93	0.92	0.96	0.42	NS
10	Task resource organizing skill	3.79	4.00	3.88	4.50	3.98	1.02	1.13	0.35	NS
11	Task resource scheduling skill	4.21	4.20	3.88	4.50	4.07	0.88	1.48	0.23	NS

Note: $T\bar{X}$ - total mean, SD- standard deviation, F-F ratio, LS- Level of significance, NS-Not significant, S-significant

4.3. Effects of craftsmen supervisors PMS on construction project success

Table 3 shows the result of Spearman's rank order correlation coefficient to determine whether there is a relationship between craftsmen supervisors PMS requirement and construction project success. The result shows the Spearman's rank order coefficient to be 0.731 ($r = 0.731$); thus indicating that there is a positive relationship between PMS and construction project success. When the coefficient was squared and multiplied by 100 ($r^2 \times 100$), the product is 53.44%; this figure is termed the coefficient of determination [28]. The coefficient of determination is a statistic that measures how much an independent variable explains the variance in the dependent variable [35]. This infers that craftsmen supervisors PMS explained 53.44% variances that determine construction project success. Moreover the null hypothesis tested at 99% confidence level stating that there is no positive relationship between craftsmen supervisors PMS requirement and construction project success was rejected, because the computed p value is less than 1 ($p < 0.01$) [35]. Thus craftsmen supervisors PMS is shown to have a positive influence on construction project success. The construction project success criteria used were adopted from Kerzner [5], and Khosravi and Afshari [26]. However this finding contrast with their study by relating craftsmen supervisors PMS with project success criteria. Moreover it implies that the more craftsmen supervisors acquire PMS, the better it is for construction project success.

Table 3. Effects of craftsmen supervisors PMS on project success.

Variables				Inferences		
S/N	X (PSF)	Y (PMSRF)	Correlation (ρ)	Coefficient of determination	LS (p)**	Decision on H_0
1	ACEUR	PMSRF	0.598	35.76	0.00	rejected
2	APS	PMSRF	0.748	55.96	0.00	rejected
3	APT	PMSRF	0.684	46.79	0.00	rejected
4	AQW	PMSRF	0.826	68.23	0.00	rejected
5	CCMW	PMSRF	0.655	42.90	0.00	rejected
6	CCSA	PMSRF	0.614	37.67	0.00	rejected
7	EEF	PMSRF	0.547	29.92	0.00	rejected
8	LACPR	PMSRF	0.573	32.83	0.00	rejected
9	PCE	PMSRF	0.608	36.97	0.00	rejected
10	PQA	PMSRF	0.522	27.25	0.00	rejected
11	SCAEI	PMSRF	0.559	31.25	0.00	rejected
12	PSF	PMSRF	0.731	53.44	0.00	rejected

Key: PSF-project success factors, PMSRF-project management skills requirement factors, LS-level of significance, H_0 – null hypothesis, ** - correlation is significant at the 0.01 level (1-tailed)

5. Conclusions and recommendations

Studies have shown that the quantity of craftsmen training in Nigeria has declined and their quality is poor compare to other developing and developed countries. This resulted in the NCI performance to be dismal due to poor productivity. Literature reviewed show that PMT is an area that needs to be explores to bridge the gap between craftsmen supervisors (line managers) and the operatives executing construction operations on sites to attain construction project success. Thus this study identified craftsmen PMS requirements and their effects on construction project success. Subsequently, a structured questionnaire was designed and administered to certify construction PM in Abuja using stratified disproportionate random sampling technique. Data were analysed using descriptive and inferential statistics. All the craftsmen PMS requirements identified were ranked relevant, and their PMS are found to be positively related to construction project success. This implied that craftsmen supervisors PMS could bridge the gap between PMA and construction operations execution. Moreover craftsmen supervisors PMS can enhance construction supervision and operations productivity to attain construction project success. Hence the study recommends PMS to be integrated in craftsmen supervisors training in Nigeria.

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