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Assessing knowledge management and time performance of building construction projects in Ghana

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ABSTRACT

The construction industry, given its nature of frequent disbanding and exit of professionals and workforce after a project is completed, cannot downplay the importance of managing knowledge and the need to manage the knowledge of construction professionals and the workforce at the corporate and project levels. This study sought to assess project knowledge management and time performance of building construction projects in Ghana. The objectives of the study were to determine whether project knowledge managed on past projects is applied on current projects, to determine the impact of project knowledge management on project time performance, and to determine the critical factors governing the application of knowledge management in enhancing project time performance. The study adopted a cross-sectional survey research design with construction professionals employed by 19 D1K1 construction companies within the Greater Accra Region of Ghana as the population. A purposive sampling method was adopted for the study, with a questionnaire as the data collection instrument. The questionnaire was administered by Google Forms, and a response rate of 69% was achieved. The study found that Ghanaian building construction firms apply knowledge gained from previous projects to current projects during construction, and the application of this knowledge managed on current projects during construction explains a 30% improvement in project time performance. Also, the findings of the study suggest improved project supervision and site management, a fully utilised construction team, and proper planning of works, among others, are critical factors that govern the application of project knowledge management for improving project time performance. These factors should be documented and applied as lessons learned on future projects to rid projects of delays and time overruns. The study would enable construction project managers to understand the extent of importance the application of project knowledge management is to a project's time performance. It will also inform construction project managers about the critical factors that the application of project knowledge management improves to enhance project time performance.

Keywords: Construction projects, Ghana, Project Knowledge Management, Time performance

1. INTRODUCTION

A project's performance is usually equated to success, and knowledge is known as a push factor for a project to achieve success (Bakar et al., 2016). Among various resources available to a company, knowledge is the most valuable because it embodies best practices, routines, lessons learned, problem-solving methods, and creative processes that are often difficult to replicate (Shonubi et al., 2021). Most organisations, including construction companies, according to Elfar and Elsaid (2017) have a competitive advantage depending on the knowledge available to them. Studies conducted on the frequency and effects of flaws and

errors in the Swedish construction process indicate that these flaws and errors account for some 6% of the total production costs and that about 10% of working time is spent on correcting errors and reworking what has been done or planned (Dosumu et al., 2017). A portion of the errors, according to Dosumu and Aigbavboa (2017), are caused by deficiencies in design work. The deficiencies include shortcomings in the knowledge available to those engaged in the construction, and a considerable proportion of the errors are also traceable to difficulties caused by vagueness or imprecision in the instructions that the design team provides of which the same problems befall the construction team (Eja and Ramegowda, 2020).

To minimise these errors, those in charge of work at the site and others engaged in the practicalities of a construction project need adequate knowledge to carry out their work properly; moreover, they need to continuously update their working knowledge to keep abreast of the latest technologies (Shamsudeen and Biodun, 2016). As a result, the industry needs to make conscious efforts to manage knowledge in the lifecycle of construction projects. Several studies (Idrees et al., 2023; Othman and ElKady, 2023; Samuel and Justina, 2023; Agyemang, 2018; Agyekum and Smith, 2017) have been conducted on knowledge management in construction. Idrees et al. (2023) conducted a study on the impact of knowledge management capabilities on organisational performance in construction firms and the mediating role of innovation. It was established that KM dimensions, knowledge acquisition, application and protection positively and significantly influence organisational performance; however, knowledge conversion is insignificant. The same study also found that innovation positively and substantially mediates the relationship between knowledge acquisition, application, protection, organisational performance and the insignificant terms of knowledge conversion. According to Othman and ElKady (2023), lack of organisational culture and low involvement of top management were identified as the highest barriers to implementing KM in architectural design firms in developing countries and also highlighted the fragmented nature of the architectural design process, which leads to the loss of valuable information and makes the process of capturing and sharing knowledge a hard task. Having conducted a study on the implementation of effective knowledge management practices for improving productivity of Nigerian Construction Small and Medium-Scale Enterprises. According to Samuel and Justina (2023), there is a high level of agreement and convergence of opinion on the effect of knowledge management on productivity. It was also concluded that knowledge management implementation improved the productivity of construction SMEs. Agyemang (2018), established that Ghanaian construction firms practice the management of knowledge. Agyekum and Smith (2017) explored the challenges to the adoption of knowledge management in civil engineering construction firms in Ghana. However, no such study focuses on assessing project knowledge management and project time performance of building construction projects. This study sought to assess project knowledge management and project time performance of Ghanaian building construction projects. The specific objectives were to determine whether project knowledge managed on previous projects is applied to current or future projects, determine the influence of the application of knowledge managed on future projects' time performance, establish critical factors that govern the application of knowledge management for enhancing time performance of projects.

2. CONCEPT OF KNOWLEDGE MANAGEMENT

During the execution of a construction project, construction professionals and the workforce tap into both codified knowledge (explicit knowledge) as well as a greater proportion of tacit knowledge. According to Bolisani and Bratianu (2018), knowledge is described as a state or fact of knowing, with knowing being a condition of understanding gained through experience or study, the sum or range of what has been perceived, discovered, or learned. This state or

fact of knowing is either codified -explicit or as well tied in the experiences and intuition, tacit, of construction professionals. Explicit knowledge, according to Gutiérrez (2012), is generally accepted knowledge that can be expressed in formal and systematic language and shared in the form of data, scientific formulae, specifications, manuals, and such like, and can be processed, transmitted and stored relatively easily. Explicit knowledge in construction embodies working drawings, specifications, etc, while tacit knowledge constitutes the lessons learned from practice and experience gained from such practice over time. According to Igbinovia and Ikenwe (2018), knowledge is defined as the process of consciously coordinating the explicit and tacit knowledge of an organisation through systematically and organizationally specified processes to enhance organisational performance and create value. These specified processes include knowledge creation, knowledge capture, knowledge sharing, and knowledge application.

2.1 Creating, capturing, sharing, and applying construction project knowledge

Creating construction project knowledge requires the existence of a person or group of people who come up with new ideas, new concepts, innovative products or processes, and can be achieved through research, innovation projects, experiments, and observations (Sondari et al., 2016).

By far, the works of Nonaka (1991, 1994), Nonaka and Konno (1998), Nonaka and Takeuchi (1995), Nonaka, Toyama and Konno (2000), Nonaka and Toyama (2003), and Nonaka, Toyama and Hirata (2008), progressively developed, refined and proposed the dynamic model of knowledge creation as a coherent and comprehensive model based on the experience of the Japanese companies (Bratianu, 2015) and it is the most discussed model in the knowledge management literature. This knowledge creation model specifies four knowledge creation modes as the processes of interplay between tacit and explicit knowledge that led to the creation of new knowledge: socialisation (tacit to tacit), externalisation (tacit to explicit), combination (explicit to explicit), and internalisation (explicit to tacit) (Hoegl, 2019). This conceptualisation is often referred to by the acronym SECI.

According to Plyasunov and Saint-petersburg (2017), capturing knowledge prevents the loss of critical knowledge due to retirement, downsizing, and outsourcing and discards the experts and professionals at the expiration of the project. Aggestam et al. (2010) expressed further that failure to capture the knowledge and experiences throughout the life cycle of a construction project is a great loss to the construction organisation and also represents unnecessary wastage of assets. Therefore, there is a need to develop an appropriate strategy for capturing construction project knowledge by using technology, techniques, concepts, and tools. Once project knowledge has been captured and codified, knowledge needs to be shared and disseminated throughout the organisation (Mohajan, 2019) and intended for use. The organisational capabilities, knowledge, and resources are developed and improved through the process of executing projects and sharing the lessons that were learned and developed through the project's execution to avoid repeating the same mistakes in the projects that follow (Ahmad and Karim, 2019). These lessons learned can be applied to subsequent projects to improve organisational capabilities and, more importantly, project performance once this knowledge is shared (Rusuli and Tasmin, 2010).

KM typically addresses one of two general objectives: knowledge reuse to promote efficiency and innovation to introduce more effective ways of doing things (Igbinovia and Ikenwe, 2018). Although the three presented processes are equally important, much premium is placed on the application of managed project knowledge on subsequent projects since management without application to ascertain the verdict on a subsequent project's performance, in this study, time performance is void.

2.2 Construction project time performance

The common assessment of the success of construction projects is that they are delivered on time, to budget, to technical specifications, and meet client satisfaction (Anoop et al., 2016). The cost, quality, and client satisfaction performance indicators of construction projects are all a function of the project's time set for completion. A successful project is a project which has accomplished its technical performance, maintained its schedule, and remained within budgetary costs (Rahman et al., 2012). These accomplishments can be made when much attention is given to the time spent executing projects. Poor performance of time can lead to a significant amount of time overrun, increase project cost, and eventually affect project quality (Othman et al., 2018). As a result, construction time is a fundamental and important parameter for measuring the success of any construction project (Harjinder et al., 2017). To avoid spending productive construction time re-inventing the wheel on an aspect of a project to cause needless extension of project duration, a rigorous application of previous project knowledge on ongoing or future projects comes in handy to save the situation.

2.3 Knowledge management and time performance

With construction project performance anchored on the projects ability to meet time schedules (Gledson, 2017), the need to meet these time schedules in a project's construction is primarily hinged on the efficiency in planning the project at the various project levels (Gledson et al., 2018). This, according to Makore and Eresia-Eke (2021), requires some amount of past experiences that have been deliberately gathered and kept intended for future use. Several other factors that cause delays in project execution and, as a result, cause time overrun, such as delays in obtaining permission from authorities, poor supervision and site management, unrealistic time schedules, unforeseen ground conditions and lack of skilled professionals (Sharma and Gupta, 2021), would have their effects minimised, if not completely avoided, when knowledge gathered on previous projects is tapped during the execution of a current project (Alhammadi et al., 2022). Knowledge as a prime asset of an organisation has an influence on the performance of the organisation (Sallam et al., 2018). According to Bayari et al. (2022), the management of knowledge affects organisational performance dimensions positively. This influence on performance includes performance on time, cost, quality, and client satisfaction, among others (Abuaddous et al., 2018). The management of knowledge not only affects organisational performance it affects the performance of individual projects' time performance as well. The management of project knowledge helps improve project time performance by informing the project team to plan work properly, monitor work closely, communicate effectively, and hire skilled workers (Al-Nabae and Sammani, 2021).

With about 10% of working time spent on correcting errors and reworking what has been done or planned (Dosumu et al., 2017), the management of previous experiences on projects goes a long way towards improving project time performance (Sallam et al., 2018: Salama et al., 2016). According to Al-qarioti (2015), projects that draw on previous project knowledge are able to perform better in meeting timelines by saving sometimes between a period of 2 to 5 months of the time scheduled for project completion.

2.4 Factors governing the application of knowledge management in enhancing time performance of construction projects

The significance of time performance in construction projects cannot be underestimated due to its effect on the cost and also a key parameter in measuring the success of construction projects (Rauzana, 2021). A project's time performance would be greatly improved if all factors that cause delay at all stages of a project's life cycle are eliminated or their effects reduced to the minimum. A major construction project setback time overrun is caused by several factors during the construction of a project (Othman et al., 2018). Adeyemi and Masalila, (2016), categorised factors that cause delays thereby affecting project time

performance into client related factors: Finance of and payments for completed work, owner interference, slow decision making, unrealistic contract duration and requirements imposed; contractor related factors: subcontractors, site management, construction methods, improper planning, mistakes during construction stage, inadequate contractor experience; consultant related factors: contract management, preparation and approval of drawings, quality assurance/control, waiting time for approval of tests and inspection; material related factors: quality of material, shortage in material; labour and equipment related factors: labor supply, labor productivity, equipment availability and failure; contract related factors: change orders, mistakes and discrepancies in contract document; contractor relationships related factors: major disputes and negotiations, inappropriate overall organisational structure linking to the project, lack of communication between the parties; and external related factors: weather condition, regulatory changes, problem with neighbours, unforeseen site conditions and project occurrences. Jagboro (2015) identified building regulations bureaucracy in government agencies, delay in obtaining permits and approvals from the government, project location, lack of experience in similar project, the complexity of the project, poor site safety, lack of communication between project members, suspension of work by owner, contractors financial difficulty, inadequate tender pricing, poor site management, inappropriate construction methods, frequent change of sub-contractors, the poor performance of contractors, more than an estimated waste of materials in the site, rework of bad quality performance, improper planning and scheduling resulting in a poor judgment of time and resources, lack of sub – contractor's skill, inadequate control over sub – contractor's, uncertainties related to sub – contractor's technical qualification, among others, as factors that cause time overrun in construction projects. The presence of these factors adversely affects the project schedule (Bekr, 2017). However, project time performance is enhanced when the factors that cause time overrun on a project are noted in the manner, they present themselves during the execution of projects and experiences drawn are brought to bear during the construction of a current or future project (Sallam et al., 2018).

3. METHODOLOGY

The study sought to determine the influence of project knowledge management practices on project time performance of building construction projects in Ghana. To achieve this aim, a quantitative research method was adopted. In line with the quantitative method, this study aligns with a deductive reasoning approach (Burney and Saleem, 2008). The study adopted a cross-sectional survey research strategy and a descriptive design to be able to find answers to the objectives stated. Two null hypotheses were developed based on the objectives stated. The null hypotheses in relation to the stated objectives are:

> H0: Project knowledge managed on previous projects is not applied to future projects in the Ghanaian construction industry and
> H0: Project knowledge management applied on a future project has no impact on the future project's time performance.

The target population of the study comprised construction professionals (construction managers, architects, quantity surveyors, structural engineers, mechanical engineers, and safety engineers) employed by D1K1 construction firms within the Greater Accra Region (the captital city of Ghana). D1K1 construction firms are first-class construction firms that have the capacity (financial and others) to execute any project (Ofori-Kuragu et al., 2017). The Greater Accra region was chosen as a study area because this region has the highest concentration of D1K1 companies. The classification of companies according to the Ministry of Water Resources Works and Housing indicates that these companies represent the highest class and have no limit to the size of the project they can undertake. According to the

Ministry of Water Resources, Works and Housing, D1K1 construction firms who are in good standing operating nationwide are 52 (Ministry of Water Resources, Works and Housing, 2019). Out of this, 19 of them are currently operating in the Greater Accra region, representing 36.5%, 10 in the Ashanti region, 4 in the Eastern region, 4 in the Central region, 3 in the Volta region, 3 in the Upper East region, 2 in Upper West region, 2 in Brong Ahafo, 3 in Northern region, and 2 in Western region (Ministry of Water Resources, Works and Housing, 2019). It is estimated that each firm averagely has three of the construction professionals targeted for this study, viz, construction managers, architects, quantity surveyors, structural engineers, mechanical engineers, and safety engineers.

3.1 Sample and sampling techniques

Two main types of sampling – probability and non-probability – are used in research: probability and non-probability sampling (Bhardwaj, 2019). Probability sampling is a sampling which permits every single subject from the population to have an equal chance of presence in the sample, while in nonprobability sampling, subjects in a population do not have the same chance of being in the sample (Bhardwaj, 2019). The respondents for the study were selected using a non-probability (i.e., purposive) sampling technique by requesting the D1K1 construction firms to ask their professionals who have been employed in their respective professional areas for at least three years to respond to the research instrument. The three–year threshold was set with the assumption that professionals employed in their various professional capacities may have had enough experience in the project knowledge management subject matter. A total of 131 questionnaires were administered, out of which 91 responses were obtained, representing a response rate of approximately 69%. This response rate is considered acceptable since the average and the acceptable response rate is 60% ± 20% (Fincham, 2008).

3.2 Data collection and analysis

This study used a structured close-ended questionnaire as an instrument for collecting primary data. A questionnaire is a systematically prepared document with a set of questions deliberately designed to elicit responses from respondents or research informants to collect data (Kabir, 2016). This choice of data collection instrument was informed by the widely geographically dispersed population. This instrument helped in reaching a greater geographically dispersed building construction professionals' population in the Greater Accra Region at a lesser time and cost. The researcher could only reach a large number of geographically dispersed construction professionals within a limited period and at a comparatively less cost through Google Forms. Google form was the means through which the questionnaire was administered. Construction professionals were requested to respond to items on project knowledge management in the Ghanaian building construction industry, on a 5-point Likert scale: 5 – strongly agree, 4 – agree, 3 – neither agree nor disagree, 2 – disagree, and 1 – strongly disagree.

The data were analysed with the aid of Statistical Package for the Social Sciences (SPSS) software. The data was analysed by means of both descriptive (Mean Score (M.S) and standard deviation) and inferential (t-test and linear regression) statistics. The mean score and standard deviation helped to present the data in a meaningful and understandable way, thereby simplifying the interpretation of the data. The t-test helped to compare a hypothesised mean with the sample mean to determine whether the difference is statistically significant while the multiple regression helped in determining the effects of knowledge management practice on project time performance.

4. RESULTS

4.1 Demographics

Gender of Respondents

The gender of the respondents is depicted in Table 1. According to the questionnaire responses, 77 of the respondents were males, accounting for 84.6% of the total, while 14 of the remaining respondents were females, accounting for 15.4%.

Professional Status of Respondents

Table 1 indicates the professional status of respondents in each category. In this study, architects accounted for 22.4% of legitimate responses, while structural engineers accounted for 11.8%. 10.6%, 23.5%, 12.9%, and 18.8% of responders were service engineers, quantity surveyors, and mechanical engineers, respectively.

Table 1: Demographics of respondents

Variable	Frequency	Per cent
Gender		
Male	77	84.6
Female	14	15.4
Total	91	100
Educational qualification		
PhD	1	1.10
Master's degree	39	42.86
First degree	44	48.35
Diploma	7	7.69
Total	91	100
Work experience		
3 – 6 years	16	17.58
7 – 10 years	25	27.47
11 – 14 years	26	28.57
Above 15 years	24	26.37
Total	91	100.00
Professionals		
Architect	18	19.80
Quantity Surveyor	14	15.40
Structural Engineer	5	5.40
Mechanical Engineer	3	3.30
Electrical Engineer	20	22.00
Building Manager	30	33.00
Safety Engineer	1	1.1
Total	91	100.0

Respondents Work Experience

The number of years' respondents have worked in the construction business is shown in Table 1. Respondents who had worked from 3 to 6 years in the construction industry were 17.58% according to the study. Respondents with working experience ranging from 7 to 10 years recorded 24.47%, 11 to 14 years recorded 28.57%, and above 15 years obtained 26.37%. The distribution of years of experience tells that the various experiences of various professionals could be tapped to help in the conclusions drawn in this study.

4.2 Application of project knowledge management to current projects

From Table 2, the mean response is 3.86, which approximates 4.00. This corresponds to 'agree' on the five-point Likert scale used for this study. A degree of variability as low as 0.38 signifies these responses are closely clustered around the mean.

Table 2: Descriptive statistics for project knowledge application

Variable	N	Mean	Std. Deviation	Std. Error
Application of previous project knowledge on other projects	91	3.86	0.382	0.040

The null hypothesis on whether project knowledge managed from a past project is applied during the execution of an ongoing project was tested using one-sample t-test and the results are summarised in Table 3. Restated; H0: Project knowledge managed from a past project is not applied to future projects.

Table 3: Output of one sample t-test for project knowledge application

	Test Value = 3					
	t	Df	Sig. (2-tailed)	MD	95% CI of the Difference	
					Lower	Upper
Application of previous project knowledge on other projects	46.36	90	0.000	1.8	1.78	1.94

Df – Degree of freedom, MD-Mean Difference, CI - Confidence Interval

From Tables 2 and 3, there is a statistically significant difference (M = 3.86, SD = 0.38), t (90) = 46.36, p = 0.000. This implies that project knowledge managed from a past project is applied to future projects, and as a result, the null hypothesis is rejected.

4.3 Influence of project knowledge management on project time performance

The null hypothesis on the influence of project knowledge management on project time performance is:

> H0: Project knowledge management of Ghanaian building construction projects has no significant influence on project time performance.

This hypothesis sought to determine whether project knowledge management has any influence on project time performance. The null hypothesis stated that project knowledge management does not influence project time performance. The regression model estimated in Table 4 reveals that the project knowledge management is statistically significant at β = 0.167, t = 3.180, p = 0.002s. The results of the regression analysis show that the adjusted coefficient of multiple determination, 0.301, implies that project knowledge management explains 30.1% of a project's performance in time. Again, the regression model is statistically significant at F (4, 86) = 4.847 and the resulting probability = 0.001. From the foregoing statistics, at a 95% level of confidence, project knowledge management has an impact on the project's time performance. Thus, the null hypothesis stating that project knowledge management has no impact on project time performance is rejected, and the alternate hypothesis that states that project knowledge management has a significant impact on project time performance is accepted.

Table 4: Results of influence of project knowledge management on project time performance.

	Unstandardised Coefficients		Standardised Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.489	0.291		1.681	0.096
Project knowledge management	0.167	0.052	.358	3.180	0.002

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
0.577[a]	0.332	0.301	0.224	1.754

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	1.342	4	.336	4.847	.001b
Residual	5.954	86	.069		
Total	5.954	86			

a. Predictors: (Constants) Project Knowledge Management b. Dependent Variable: Project Time Performance

4.3 Critical factors governing the application of knowledge management in enhancing project time performance

The study assessed factors governing the application of managed project knowledge that enhances or improves a current project's time performance. Several factors were suggested for respondents to express the extent to which they agree with them as helping improve project time performance. Table 5 provides descriptive results of the critical factors governing project knowledge management for enhancing project time performance. This is followed by Table 6, which presents one sample t-test for critical factors governing project knowledge management for enhancing project time performance.

Table 5: Descriptive statistics of factors governing the application of knowledge management in enhancing project time performance.

	N	Mean	SD	St. Error
Improved project supervision and site management	91	4.86	0.436	0.046
Proper planning of works	91	4.90	0.396	0.042
Committed leadership and management	91	4.81	0.492	0.052
Proper planning for tools and equipment	91	4.85	0.470	0.049
Send clear and complete messages to workers to ensure effective communication	91	4.87	0.427	0.045
Hire skilled workers to achieve good progress, avoid double-handling	91	4.91	0.384	0.040
Focus on the quality, cost and delivery of the project	91	4.88	0.443	0.046
Training and development of all participants to support the delivery process	91	4.82	0.462	0.048
Reduced staff absenteeism	91	4.73	0.651	0.068
Fully utilise the construction team	91	4.81	0.492	0.052
Use new construction technologies (IBS-Industrialize Building System)	91	4.79	0.506	0.053
Focus on the client's need	91	4.82	0.485	0.051
Adoption of tools and techniques, i.e., Value Management, Lean Thinking, etc.	91	4.86	0.436	0.046
Measure performance against other projects	91	4.84	0.543	0.057
Helps in getting over design changes in record time	91	4.77	0.579	0.061
Helps in evaluating project duration accurately	91	4.81	0.595	0.062
Informs the need to appoint competent subcontractors and suppliers	91	4.79	0.606	0.064

Informs the recruitment of the needed quality and quantity of labour	91	4.84	0.478	0.050
Helps in the swift resolution of conflicts between project parties	91	4.80	0.477	0.050
Helps in better assessment of weather conditions	91	4.77	0.579	0.061
Helps in assessing ground conditions	91	4.82	0.485	0.051
Informs the usage of appropriate construction methods	91	4.86	0.461	0.048
Helps avoid needless rework caused by mistakes	91	4.86	0.436	0.046
Helps properly programme and schedule works to minimise staff idle time	91	4.85	0.445	0.047
Improves problem-solving and decision-making	91	4.88	0.417	0.044
Minimises construction site labour unrest (boycotts, strikes, etc.)	91	4.78	0.574	0.060
Helps to minimise litigation	91	4.74	0.647	0.068
Helps facilitate prompt payments by clients	91	4.77	0.579	0.061
Helps improve documentation and procedure	91	4.85	0.445	0.047
Helps in material ordering and scheduling	91	4.85	0.445	0.047
Fast tracks contract design and specification interpretation disagreements	91	4.85	0.470	0.049
Informs proper plant and equipment management to avoid needless breakdown	91	4.86	0.436	0.046
Aggregate scores	**91**	**4.82**	**0.50**	

All respondents for the study, as depicted in Table 5, strongly agreed that the application of knowledge managed from a previous project on current or future projects helps improve these factors and, consequently, project time performance. Table 6 further shows that there is a significant difference in the mean scores. This significant difference in means of the responses to the critical factors to the test value of 3 implies that the responses of the professionals strongly agreeing to the factors are not by chance.

The aggregate mean score for the ways by which project knowledge applications improve project time performance is 4.82, approximating 5. A mean score of 5 on the five-point Likert scale used for this study represents strongly agree. This suggests that the professionals agree strongly that knowledge of the project, when applied, helps improve project time performance by way of the factors as presented in Table 5. A standard deviation of 0.07 represents very less variability in responses and also suggests that the responses are clustered close to the mean.

Table 6: Output of one sample t-test for factors governing the application of knowledge management in enhancing project time performance

	Test Value = 3					
	t	**df**	**Sig. (2-tailed)**	**MD**	**95% CI of the Difference**	
					Lower	**Upper**
Improved project supervision and site management	62.45	90	0.000	2.85	2.77	2.95
Proper planning of works	69.89	90	0.000	2.90	2.82	2.98
Committed leadership and management	54.49	90	0.000	2.81	2.71	2.92
Proper planning for tools and equipment	57.81	90	0.000	2.84	2.75	2.94
Ensure effective communication	64.06	90	0.000	2.86	2.78	2.96
Hire skilled workers to achieve good progress, avoid double-handling	72.27	90	0.000	2.91	2.83	2.99
Focus on the quality and cost of the project	61.98	90	0.000	2.87	2.79	2.97
Training and development of all participant	58.34	90	0.000	2.82	2.73	2.92

Reduced workforce absenteeism	39.94	90	0.000	2.72	2.59	2.86
Fully utilise the construction team	54.49	90	0.000	2.81	2.71	2.92
Use new construction technologies (IBS)	52.63	90	0.000	2.79	2.69	2.90
Focus on the client's need	55.52	90	0.000	2.82	2.72	2.93
Adoption of tools and techniques, i.e., Value Management, Lean Thinking,	62.45	90	0.000	2.85	2.77	2.95
Measure performance against other projects	49.81	90	0.000	2.83	2.72	2.95
Helps in getting over design changes on time	45.63	90	0.000	2.76	2.65	2.89
Helps in evaluating project duration	45.13	90	0.000	2.81	2.69	2.94
Informs the need to appoint competent subcontractors and suppliers	43.95	90	0.000	2.79	2.67	2.92
Helps in swift resolution of conflicts	56.09	90	0.000	2.80	2.70	2.90
Helps in better assessment of weather	45.63	90	0.000	2.76	2.65	2.89
Helps in assessing ground conditions	55.52	90	0.000	2.82	2.72	2.93
Informs the usage of appropriate construction methods	59.09	90	0.000	2.85	2.76	2.95
Helps avoid needless rework	62.45	90	0.000	2.85	2.77	2.95
Helps properly schedule works to minimise idle time	60.97	90	0.000	2.84	2.75	2.94
Improves problems solving and decision making	65.82	90	0.000	2.87	2.79	2.97
Minimises construction site labour unrests	46.24	90	0.000	2.78	2.66	2.90
Helps to minimise litigations	40.34	90	0.000	2.73	2.60	2.87
Helps facilitates prompt payments	45.63	90	0.000	2.76	2.65	2.89
Helps improve documentation and procedure	60.97	90	0.000	2.84	2.75	2.94
Helps in material ordering and scheduling	60.97	90	0.000	2.84	2.75	2.94
Fast tracks contract design and specification disagreements	57.81	90	0.000	2.84	2.75	2.94
Informs proper plant and equipment management to avoid needless breakdown	62.45	90	0.000	2.85	2.77	2.95

5. DISCUSSION OF THE FINDINGS

5.1 Application of project knowledge management to current projects

The current study established that building project knowledge, when managed, is indeed applied during the execution of a current project. The findings of this study accord with that of Ranf and Herman (2018). Ranf and Herman (2018) found that project managers apply managed knowledge on previous projects in the project management activities of a current project. Falqi (2017) and Anumba et al. (2005a) are also of a similar view that the application of knowledge or experiences drawn from a previous project on a current ongoing project is a regular practice by construction professionals and workforce, although no two projects are the same. This suggests that during the construction of a current building project, ideas and experiences drawn and carried by professionals and workforce and managed are brought to bear.

5.2 Influence of project knowledge management on project time performance

The results of the multiple regression from Table 3 show that project knowledge management explains some 30 per cent of a project's time performance. This implies that the conscious application of previously managed knowledge to current or ongoing projects has some positive influence on an ongoing or a current project's time performance. Drawing on previous experiences consciously managed helps to mitigate the extent of delays caused by decision making, construction site labour unrests (boycotts, strikes, etc., litigations arising during project delivery and actions that could bring about litigation, payments by clients, documentation, and procedure, material ordering and scheduling, design and specification interpretation disagreements, plant and equipment management this study finds. Managing

and applying project knowledge on future projects helps improve project supervision and site management; pull together committed leadership and management; inform the need to hire skilled workers to achieve good progress, avoid poor quality of work, more rectification and double handling; helps in getting over design changes in record time Guribie and Tengan (2019), training and development of all participant to support project delivery process; proper planning for tools and equipment; measure performance against other projects; focus on the quality, cost and delivery of the project; reduce staff absenteeism; helps in evaluating project duration accurately; informs the need of appointing and aids in appointing competent subcontractors and suppliers; send clear and complete message to operatives to ensure effective communication; proper planning of works; informs the recruitment of the needed quality and quantity of skilled and unskilled labor; helps in swift resolution of conflicts between project parties, helps avoid needless rework caused by mistakes; minimises construction site labor unrests (boycotts, strikes); helps to minimise litigations arising during project delivery and actions that could bring about litigation, helps in material ordering and scheduling; fast-track contract design and specification interpretation disagreements; informs proper plant and equipment management to avoid needless breakdown, helps in better assessment of weather conditions; informs the usage of appropriate construction methods; helps properly program and schedule works to minimise staff idle time; improves problems solving and decision making; fully utilise the construction team; use new construction technologies (IBS-Industrialize Building System); focus on client's need; Provide knowledge/training to unskilled workers based on their scope of work, helps facilitates prompt payments by clients; helps improve documentation and procedure (Oluikpe et al., 2011). These factors cause delays in projects. The lessons learned and the experiences drawn on previous projects avoid the impact of these critical factors on project duration. When knowledge of the previous project is managed and applied to future projects, reworks and 're-inventing the wheel' waste time avoided, and projects tend to save considerable time.

5.3 Critical factors governing the application of knowledge management in enhancing project time performance

The building construction professionals affirmed strongly that upon the application of project knowledge management, some critical factors are impacted which, consequently, enhance project time performance, viz: project supervision and site management, planning of works, committed leadership and management, planning for tools and equipment, send clear and complete message to worker to ensure effective communication, hire skilled workers to achieve good progress, avoid double handling, focus on the quality, cost and delivery of the project, training and development of all participant to support delivery process, staff absenteeism, construction team utilisation, usage of modern construction technologies, focus on client's need, adoption of tools and techniques i.e., Value Management, Lean Thinking, etc., measurement of performance against other projects, getting over design changes in record time, accurate evaluation of project duration, appointment of competent subcontractors and suppliers, recruitment of the needed quality and quantity of labor, resolution of conflicts between project parties, assessment of weather conditions, ground conditions assessment, usage of appropriate construction methods, rework caused by mistakes, works programming and scheduling to minimise staff idle time, problems solving and decision making, minimisation of litigations, payments by clients, material ordering and scheduling, contract design and specification interpretation disagreements, plant and equipment management. These causes of project time overrun established by (Soomro et al., 2019) are said to be positively impacted when project knowledge of a previous project is managed and drawn on during the execution of a future project (Grabar and Grd, 2014) and as a result helps improve the time project's time performance (Alyoubi et al., 2018).

6. CONCLUSION

The management of knowledge of the workforce in organisations has become an organisational pre-requisite since labour turnover is on the increase. The construction industry, characterised by disbanding a project team and a greater number of workers going their way after a project is completed, loses valuable experience that is carried away in the heads of professionals and the workforce as teams disband after a project is completed. This loss can be avoided by managing the knowledge carried by this project workforce. This study sought to establish whether project knowledge managed on the previous project is applied to future projects in the Ghanaian construction industry, determine whether the application of such knowledge has an impact on future project time performance, and establish the factors by which the application of project knowledge managed helps improve to improve the time performance of a future project.

The study concludes that the Ghanaian construction industry taps from the depth of knowledge managed from previous projects and applies this knowledge during the construction of a future project. This application, according to this study, consequently influences project performance positively by saving the project about 30% of the total project duration. Since project time performance is improved on the application of previously managed knowledge to current projects, this study recommends that building construction project teams must pay attention to factors that cause time overrun during the construction of a project, attempt to note these factors as they occur and the manner which these occur, document lessons learned and apply these lessons learned to future projects to rid projects of delays. A limitation of this study is that the findings of this study are based on the opinions of the professionals that were studied. A study on the whole construction project workforce could have given a deeper understanding. Further research is recommended to be conducted on other construction workers.

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