PROJECT RISK MANAGEMENT AND CONSTRUCTION PERFORMANCE: A GHANAIAN STUDY

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ABSTRACT

Project risk management is a useful tool for planning and controlling cost, time and quality as well as achieving the best performance of a construction project. Usually, construction projects face a lot of risk and uncertainties, which puts construction projects at the risk of cost, time overruns as well as low-quality delivery. The research aimed to examine the effects of the application of risk management tools and techniques on the performance of construction projects performance in terms of time, cost and quality within the Tamale metropolis. The study employed quantitative research methods. One hundred and nine (109) survey questionnaires were designed and administered face to face to contractors, site managers and project managers in the Tamale metropolis and a total number of ninety-six (96) were recovered representing a response rate of 88.07%. The data gathered were organised and analysed using descriptive statistics, factor analysis and regression analysis. The study found that risk management practices within construction projects are not actively conducted. Also, the study found that project professional utilised qualitative tools and techniques then quantitative tools, in that decision-making process is centred at the top-level management. The study found that selecting risk management tools and techniques have a positive influence on project performance. The study recommend that decision making should be decentralised to enhance effective implementation and easy understanding of risk strategy, goal and objectives, duties and contents of the service and feasibility of the project. This will go a long way to help in eliminating future disputes and variations between parties during the construction stage. It is therefore recommended that project professionals undergo holistic risk management pieces of training, seminars and workshops to enable them to acquire all necessary knowledge and skills required to understanding quantitative tools and techniques and its smooth implementation.

INTRODUCTION

The construction industry is the largest globally, and precious industries in the most nation as it offers shelter, work and recreational facilities for the citizenry (Lam et al., 2010; Elbeltagi, 2009). Construction projects include, among other things, building houses, highways, hospitals, bridges, parks, factories and worship centres. Despite being a dominant part of the economy, managerial inefficiencies, the construction industry is more challenging than other industries due to: its uniqueness; every project is one-of-a-kind; many conflicting parties are involved; projects are constrained by time, money and quality; and high risk (Elbeltagi, 2009). The construction industry changes which necessitate a need for an industry to be dynamic to keep pace (Adeleke, 2019), this constant change exposes the construction industry to high risk. The construction industry has been unsuccessful in creating and sustaining economic growth through innovation as compared to the industrial sector (Murphy et al., 2015).

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Risk makes the construction sector very complicated and can pose numerous internal and external threats that can stifle efficiency and even bring a well-respected and well - established company to its knees. It is therefore essential to handle the multifaceted risk connected with the construction industry in executing construction projects, not only to allow these companies to survive or secure jobs but also to make profits.

The goal of the construction project is to build something (Elbeltagi, 2009). Construction projects are varied in term of size, which involves the risk of varying degrees of impact (Hwang, et al. 2014). Construction projects are different from other projects, because of, it's generally uniqueness, built on-site and consumes resources such as time, money, labour, equipment, and materials (Elbeltagi, 2009). According to Bahamid & Doh, (2017), Construction risk is usually viewed as occurrences that impact project objectives of cost, time and quality. Therefore, managing project risk is an integral part of quality project management system, and necessary to achieve good project outcomes. That is, systematic identification and assessment of risk and effectively dealing with the results is significant to the success of the project (Abdul et al., 2015). Risk management has become an essential aspect of project management in that; it is identified as one of the leading project management knowledge areas in the project management body of knowledge (PMBOK) by the Project Management Institute (PMI, 2017). Risk management is an essential decision-making method in managing construction projects efficiently and must be maintained throughout the life cycle of the project, and should be based on intuition and previous experience for a high level of judgement (Abdul et al., 2015).

Many organisations from different sectors have acknowledged the growing significance of risk management, and many have developed risk management units or departments to regulate the risk they might be or are exposed to (Chapman & Ward, 2011). This is necessary for the construction industry because the sector is believed to be operating in a highly volatile environment (Bahamid & Doh, 2017). Also, this sector has a strong connection with its stakeholders. Abdul-Rahman et al., (2015) defined construction project stakeholders as individuals and organisations who are actively engaged in construction project and as a consequence of project implementation or project closure, their interests may be favourably or negatively influence the project deliverable. Similarly, Banaitiene & Banaitis (2012) posited that stakeholder's expectations generate issues and confusion for even the most experienced project executives and contractors. Risk management, therefore, enables integration of project participants–clients, contractors or developers, consultants and suppliers – fulfil their obligations and minimise adverse effects on project results in terms of cost, time and quality (Adeleke, 2019).

Risk management is a continues and iterative process which identifies, analyse, evaluate and prioritise, treat and communicate risk across to all levels of the organisation. In the process of risk management, there is several tools and techniques which can be applied with varying levels in the risk management process ranging from risk identification to risk communications. In literature, risk management tools and techniques are identified as qualitative and quantitative tools and methods (Hayford & Ahmed, 2013). Risk management tools and designs are the things and ideas which are used in identifying, assessing and as well as controlling risk in an organisation (Shaban & Enshassi, 2008). The purpose of risk management tools and techniques is to give organisations an excellent way to create the best possible risk management strategy and draw upon best practice to help to develop guidelines and tricks which can help to make the risk management process much more comfortable to complete (Siang & Ali, 2012). However, application of those tools depends on the nature of the project, organisation's policy, project management strategy, risk attitude of the project team members, and availability of the resource (Dey & Ogunlana, 2004).

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An Overview of Risk Management

Risk management is one of the nine knowledge areas of project management. It becomes an integral part of construction management which intends to identify and manage potential and unforeseen risks during the period of implementation of the project. Although risk management is seen as an essential component of project management and is widely studied, there is no uniform definition for risk management. Risk management is a process which identifies the project risks, analyse them, and determine the actions to avert the threats on any project (Mahendra, et al. 2013). Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project (PMI, 2017).

Risk management in construction is intended to plan, monitor and control those measures needed to mitigate exposure to risk (PMI, 2017). Managing risks in construction projects have been recognised as an essential process to achieve project objectives in terms of time, cost, quality, safety and environmental sustainability (Jia et al, 2013). Risk management applied systemically, helps to control those critical elements which can negatively impact project performance as well as assess and respond to the risk that will be inevitably attached to a project (PMI, 2017). Risk management process is the basic principle of understanding and managing risks in a project (Siang & Ali, 2012). In that, all steps in the Risk Management Process should be included when dealing with threats, to efficiently implement the process in the project (Bahamid & Doh, 2017). Project risk management is an iterative process: the process is beneficial when implemented systematically throughout the lifecycle of a construction project, from the planning stage to completion (Jia et al., 2013). This will help to determine what impact each risk will have and the probability that it will occur. Hence prioritising risk taking into account how much time, money and work each risk will require to manage effectively (Bahamid & Doh, 2017). There are numerous risks which can be identified in the construction industry and inherent in each construction project regardless of its size and scope. In that, risk management is most effective when first executed at the Pre-project phase of the project and is a continuing responsibility throughout the project's life cycle. It is also essential to consider the overall project risk, which arises from the combination of internal project risks and other sources of uncertainty. Project risk Management processes address both levels of risk in projects.

Projects Risk Management Tools and Techniques

The risk management tools and techniques are to gives organisations an excellent way to create the best possible risk management strategy and draw upon best practice to help to develop guidelines and tricks which can help to make the risk management process much more comfortable to complete (Siang & Ali, 2012). Project risk management tools and techniques can be put into qualitative and quantitative tools and techniques (Hayford & Ahmed, 2013). Quantitative Risk Analysis is the process of numerically analysing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives (PMI, 2017). Quantitative risk analysis is the process of numerically analysing the combined impact of identified individual project risks and other sources of uncertainty on overall project objectives. Project management tools and techniques into five (5) groups in correspondence to the risk management process (Raz & Michael, 2001). Unlike Quantitative tools and techniques, qualitative tools and techniques are more scenario-driven and don't assign numeric values to the components of the risk analysis (PMI, 2017). Qualitative risk analysis is done by using the personal experiences of the risk analysts

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and reviewing past corporate experiences where records are available (Carter & Chinyio, 2012).

Risk Management and Project Performance

Risk management is an important area of project management then, since it allows anticipating the occurrence of events that could adversely affect a construction project and to define actions that could minimize their impacts. It is well known that one of the major roles undertaken by any project manager is to deal with contingencies or risks that occur continuously during the management of a project and this role is particularly complex and inefficient if risk management has not been performed or supported adequately since the start of the project. To make risk management an effective and efficient function, it is necessary to have a proper and systematic methodology and, more importantly, knowledge and experience of various types. A construction project is considered to be successful when the project is completed on contracted schedule time and within budget without compromising the specified standards of quality (Al-Shibly et al. 2013). Measuring the performance of a construction project is a complex process and multidisciplinary in nature (Demirkesen, & Ozorhon, 2017). Risk management enables construction professionals to fulfil their obligations and ensure that project objectives are achieved (Shaban & Enshassi, 2008). The importance of practising risk management is to increase the sustainable value of construction activities (Siang & Ali, 2012).

Marketing as a Measurement of Construction Performance

Marketing management is critical to the success of any business. However, marketing has been either misinterpreted or completely ignored in many construction organizations since it is difficult to implement traditional marketing tactics owing to industry-specific features. Because of its direct influence on profitability, client happiness, and business success, marketing management is one of the most significant operations in all business sectors. Sustainable growth, increased profits, increased sales and client satisfaction, brand development, entry into new markets, improved customer loyalty and reputation, improved procurement processes and coordination capability, and quality improvement are just a few of the benefits of effective marketing for construction firms.

Research Method

This study employed a survey as an appropriate and best suit strategy whiles using Cross-sectional design for the research work. Survey questionnaires were used as the main source of primary data collection and administered to the individual respondents selected from the various construction projects. Questionnaires were chosen because the respondents were believed to know about the topic, and they are competent to answer the questions. Group of individuals known as construction professionals were identified as the unit of analysis and selected using a purposive sampling method. Ninety-six (96) construction professionals were chosen from contractors, project managers and site managers. These units of study were believed to have adequate knowledge in managing construction projects.

Findings and Discussions

This section of the study presents information on demographics, exploratory factor analysis and regression analysis results. Descriptive statistics were used to analyse the characteristics of the respondents. Exploratory Factor Analysis (EFA) was used to gather

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information about the unidimensionality of the variables. The results from factor analysis were subjected to Regression Analysis to determine the relationship between risk management tools and techniques and construction project performance Table 1.

Table 1
RESPONDENT CHARACTERISTICS

Respondents education	Frequency	Percentage %
Primary	36	37.50
SHS / Vocation	32	33.33
Tertiary	28	29.17
Total	96	100
Respondent experience		
Contractors	52	54.17
Site managers	27	28.13
Project managers	17	17.70
Total	96	

The study found that the majority of respondents attained formal education and have about 5-10 years of experience in managing and dealing with construction projects. This showed that respondents had obtained enough experience and in-depth knowledge about the construction industry and handling of construction projects. The respondent was made up of contractors, site managers and project managers Table 2.

Table 2
KMO AND BARTLETT'S TEST; TOTAL VARIANCE EXPLAINED

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.							.642		
Bartlett's Test of Sphericity				Approx. Chi-Square			700.786		
				Df			120		
				Sig.			.000		
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.81	30.08	30.08	4.81	30.08	30.08	3.8	24.01	24.01
2	3.76	23.52	53.60	3.76	23.52	53.60	3.6	22.44	46.45
3	2.68	16.76	70.36	2.68	16.76	70.36	2.5	15.92	62.37
4	2.11	13.19	83.55	2.11	13.19	83.55	2.4	15.17	77.54
5	1.21	7.545	91.10	1.21	7.545	91.10	2.2	13.56	91.10
6	.649	4.056	95.15						
7	.427	2.668	97.82						
Extraction Method: Principal Component Analysis.									

The KMO was 0.642, and Bartlett's Test of Sphericity was statistically significant at p=0.000 (<0.05), indicates that the sample is adequate, and factor analysis can be performed (Hair et al., 2006). Five (5) factors had eigenvalues of more than one (1) with a cumulative % of 91.10%. They are thus accounting for about 91% of the total variance.

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Table 3 ROTATED COMPONENT MATRIX[A]					
	Component				
	1	2	3	4	5
Customer Satisfaction				0-0.883	
Risk Avoidance			0.746		
Spreadsheets		0.909			
Balanced Scorecards		0.881			
Cost-Benefit Analysis			0.900		
Contingency plans for Risk Analysis			0.766		
Requirement Assignment	.978				
Risk Documentation		0.723			
Quality Control and Management	0.955				
Benchmarking	0.800				
Cause-Effect Analysis	0.781				
Risk Classification		0.592			
Risk Prioritization				0.852	
Re-Planning of Projects					0.802
Risk Quantitative Simulation		0.860			
Brainstorming					0-.0936
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 6 iterations.					

Tables 4 & 5 were deleted; their reliability was further calculated to support the need to delete them. The remaining factors were named as Quantitative tools for Factor 1, Qualitative tools for Factor 2, and combined tools for Table 3.

Table 4 RELIABILITY STATISTICS		
Factors	Cronbach's Alpha	N of Items
Factor 1 (Qualitative Tools)	0.920	4
Factor 2 (Quantitative Tools)	0.879	5
Factor 3 (Combined Tools)	0.749	3
Factor 4 (Deleted)	-3.911	2
Factor 5 (Deleted)	-3.918	2
Construction Firm Performance	0.832	3

Table 1 (existing risk management tools and techniques) produced a Cronbach's alpha of 0.920; Table 2 (internal risk management tools and techniques) produced a result of .879, and Table 3 (external risk management tools and techniques) recorded an alpha .749. However, Tables 4 and 5 recorded reliability results of -3.911 and -3.918, respectively. Hence Table 4 and 5 were excluded for further analysis. Meanwhile, the reliability results of construction project performance recorded 0.832.

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Factor 1: Qualitative Tools and Techniques

This factor suggests planning for projects and relies on the project scope statement and risk management plan. Project professionals must ensure a routine collaboration between the project team and a regular risk review pieces of training and workshops. Qualitative analysis is done by using the personal experiences of the risk analysts and reviewing past corporate experiences where records are available. Hence project professionals' needs to prioritise risk according to probability impact, identify the main areas of risk exposure and improve understanding of construction project risk. This will help give project professionals the clarity to prioritise tasks quickly and cost-effectively. This factor explains 24.01% of the variability on the performance of construction projects. Project professionals must have adequate expertise on the qualitative tools and techniques to perform better than the benchmark.

Factor 2: Quantitative Tools and Techniques

This factor suggests evaluating all the project risk from individual risk plus other sources of risk. This provides more objective information and data than factor 1. Quantitative tools and techniques quantify the possible outcomes for the project and assess the probability of achieving specific project objectives, provides a quantitative approach to making decisions when there is uncertainty and creates realistic and achievable cost, schedule or scope targets. Quantitative risk analysis is a further analysis of the highest priority risks during which a numerical or quantitative rating is assigned to develop a probabilistic analysis of the project. This explains 22.44% of the variability in construction project performance. It is necessary for project professionals to numerically estimate the overall effects of risk on a construction project concerning cost, time and quality.

Factor 3: Combined Tools and Techniques

This factor suggests the creation of integration of quantitative and qualitative tools and techniques to leverage on the shortfalls of both approaches and create a more comprehensive analytical approach. This explains 15.92 % of variability on construction project performance**.** Project professionals need to have adequate knowledge in integrating Factor 1 and Factor 2 to improve project performance. The best risk management tools and techniques for construction projects is the combined tools and techniques. Hayford & Ahmed (2013) concluded that the long term solutions comprising both qualitative and quantitative technique should be sort for.

To further explore the relationships between risk management tools and techniques and construction project performance, the results of the factor analysis was also subjected to regression analysis to establish the relationships between risk management tools and techniques and construction project performance.

Table 5
MODEL SUMMARY AND ANOVA[A]

Model	Adjusted R Square	Model		Sum of Squares	Df	Mean Square	F	Sig.
1	.137	1	Regression	5.335	3	1.778	5.714	0.001[b]
			Residual	26.765	86	.311		
			Total	32.100	89			
		a. Dependent Variable: Construction Firm Performance						
		b. Predictors: (Constant), F3, F2, F1						

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The adjusted R square was 13.7 %. This finding suggests that the three factors jointly explain about thirteen-point seven per cent of variations in construction performance. Table provides ANOVA of the regression. F statistic was significant at 5.714. The coefficients are presented in table 5. The low adjusted R^2 suggested that risk management tools and techniques were not a good predictor of project performance.

Table 6
COEFFICIENTS[A]

Model		Unstandardised Coefficients		Standardised Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	4.238	.343		12.372	.000
	Qualitative Tools (F1)	-.246	.071	-.376	-3.436	.001
	Quantitative Tools (F2)	.222	.069	.339	3.220	.002
	Combined Tools (F3)	.128	.068	.205	1.873	.064

a. Dependent Variable: Construction Project Performance

Both qualitative and quantitative tools were found to be significant with construction firm performance. There is a negative relationship between qualitative tools and construction firm performance. At the same time, there is a positive relationship between quantitative tools and construction firm performance. Also, there are positive relationships between combined tools and project performance. Arguably, there are no existing studies consistent with these findings. However, Banaitiene & Banaitis (2012) concluded that the risk management framework for construction projects could be improved by combining qualitative and quantitative methodologies of risk analysis. Similarly, Hayford & Ahmed (2013) posited that the long term solutions comprising both qualitative and quantitative technique should be sort for. The findings of this study suggest that effective application of risk management tools and techniques enables project risk responses and mitigation strategies to avoid project cost overrun, delays and ensure project completion within the stipulated period.

Conclusion and Recommendations

Construction is a risky business. Project managers need to manage risks properly in order to deliver projects successfully. Successful project delivery means completing projects on time, within budget and within quality and safety expectations. Managing risk is fundamental to the successful delivery of every construction projects. Construction companies respond to risks by adopting various risk management practices. Risk management tools and techniques affect construction project performance. Three factors were identified to constituting risk management tools and techniques in this study comprising of qualitative risk management tools and techniques; quantitative risk management tools and techniques; and combined risk management tools and techniques. The study found a positive relationship between quantitative and integrated risk management tools and techniques and construction projects performance. Improving quantitative and combined risk management tools and techniques will enhance and improve construction project performance. However, qualitative tools and techniques showed a negative relationship with construction project performance.

The construction industry possess a poor reputation for risk management, saddled with lots of uncertainties owing to the subjective judgment of expert assessment, thus causing projects to miss their cost targets and deadlines (Chatterjee et al., 2018). The Ghanaian

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construction industry needs knowledge in risk management practices to better position them to meet the ever increasing demands of clients (Ijigah, et al. 2015). Accordingly, the curriculum for education institutions in Ghana should include risk management so that after the students graduate and join the construction industry, they will not only be aware of risk management, but they will know how to carry out the processes. Construction organisations in Ghana need to organise training programmes on project management especially risk management for their employees so as to equip them with the necessary tools and techniques required in managing projects and understanding risk management. The study recommend that decision making should be decentralised to enhance effective implementation and easy understanding of risk strategy, goal and objectives, duties and contents of the service and feasibility of the project. This will go a long way to help in eliminating future disputes and variations between parties during the construction stage. It is therefore recommended that project professionals undergo holistic risk management pieces of training, seminars and workshops to enable them to acquire all necessary knowledge and skills required to understanding quantitative tools and techniques and its smooth implementation.

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