RISK MANAGEMENT KNOWLEDGE AND PRACTICES IN THE GHANAIAN CONSTRUCTION INDUSTRY

Mr. Andrew Hansen-Addy
Prof. Edward Fekpe
Business School
Ghana Institute of Management and Public Administration
Accra, Ghana

Abstract

Ghana, and probably like many developing countries, has a weak construction sector with little regulation and standards for infrastructural development. The skills gap of many construction workers is seen in poor quality construction works, poor workmanship, and injuries. Risk management, on the other hand, is seen as integral decision making process in managing construction projects effectively. The primary objectives of this study were to explore: current risk management knowledge of construction professionals; and common risk management practices employed by construction professionals. Primary data was collected through in-person interviews from Contractors, Project Managers, Architects, Quantity Surveyors, Consultants, and Clients, who were identified through random sampling. The study revealed that construction professionals in Ghana generally consider themselves to have intermediate knowledge and experience of risk management practices; 'Brainstorming sessions' is their most frequently used risk identification practice; and reliance on consulting experts is their most frequently used risk analysis practice. It also emerged from the study that the perceived top five important risks to construction projects are 'Financial issues,' 'Inadequate or incorrect Architectural and Engineering design details,' 'Poor quality of materials supplied,' 'Failure to meet Project quality estimates,' and 'Failure to meet Project cost estimates.' It is recommended that risk management training is given to more construction professionals so they are better equipped to manage risks that occur in construction projects.

Keywords: Risk management, construction industry, project management

Introduction

Construction contributes immensely to economic growth and development in developed and developing countries. Research in the construction industry show that it contributes between 5 and 10 percent of gross domestic product (GDP) in all countries, employs up to 10 percent of the working population, and is responsible for about half of the gross fixed capital formation. In Ghana, the construction industry contributes about 6-10% of GDP and provides employment for 3.1% of the Ghanaian Labour force (GSS, 2012). Additionally, the industry employs a wide range of both skilled and unskilled labour on projects all over the country (GSS, 2012). The industry has a real potential to transform the Ghanaian economy and improve the livelihoods of many Ghanaians.

Ghana, and probably like many developing countries, has a weak construction sector with little regulation and standards for infrastructural development. The skills gap of many construction workers is seen across the country in poor quality construction works, poor workmanship, structural failures and avoidable fires and injuries (Ahadzie & Amoa-Mensah, 2010). According to Ofori (2006), the construction industry in Ghana is faced with a myriad of technical, non-technical and unique project management challenges. The non-technical challenges include lack of know-how, skills and experience needed to deliver projects.

Risk management, on the other hand, is seen as integral decision making process in effectively managing construction projects. It affords project stakeholders hands on knowledge and tools to manage foreseeable and unforeseeable events which occur in project delivery. A lack of proper risk management often leads to project delays, cost overruns, and may also result in project failure. This research seeks to ascertain current risk management knowledge and practices in the Ghanaian construction industry.

Research Justification And Objectives

Recent calls for the regulation of the construction industry in the light of recent catastrophic structural failures of multi storey buildings is giving impetus to research in construction practices that will lead to relevant policy adjustments in the sector. Furthermore, there is abundant literature on risk management in construction projects mainly in developed countries. Corresponding research in less developed countries is rather limited. In Ghana, more recent studies focused on the perceptions of contractors, clients and consultants within medium and large construction-related organisations regarding the likelihood of occurrence and severity of impacts of construction project risk factors (Chileshe & Yirenkyi-Fianko, 2011). However, little research has been done to investigate the extent of risk management knowledge and practices in the Ghanaian context. The primary objectives of this research are to explore: current risk management knowledge of construction professionals; and common risk management practices employed by construction professionals in Ghana.

Literature Review

Construction processes are to a large extent unique and complex giving rise to numerous challenges or risks; risks that ultimately determine the extent to which project requirements are met. Managing risks, which are inevitably part of any construction management process, is therefore essential in successful project delivery. Failure to manage potential risks on projects adequately can have adverse effects on the overall success of the project (Osipova & Eriksson, 2011; Schieg, 2006; Zou, et al., 2010).

Risk management is a widely researched subject matter in construction management with several approaches and techniques proposed and discussed in literature. Risk management involves four (4) fundamental steps namely:

1) Risk Identification – This step attempts to determine potential risks inherent in any project including sources of risks. This step is undertaken using a number of approaches including brainstorming, consultations, and use of checklists and analysis of historical data of similar projects. Risk identification is critical to efficient management of risks on construction projects. (Banaitiene, et al., 2011; Tadayon, et al., 2012; Abdul-Rahman, et al., 2012).,
2) Risk Assessment – In this step, a qualitative and quantitative analyses are conducted. The qualitative analysis assesses the probability of occurrence of risks and the severity of such occurrence on a project. The quantitative analysis attempts to quantify the impacts of risk occurrence on the project in terms of costs and time. Methods used include fault tree analysis, event tree analysis, sensitivity analysis, failure mode and effect analysis and the Monte Carlo simulation. (Banaitiene, et al., 2011; Imbeah & Guikema, 2009; Khedr, 2006; Edwards & Bowen, 1998; Nasirzadeh, et al., 2008).
3) Risk Response – Involves a formulation of strategies to deal with identified and assessed risk events when they occur. Four (4) main strategy groups are proposed in literature depending on the type of risk. They are risk avoidance, risk mitigation, risk transfer and risk acceptance (Abu Bakar, et al., 2012; Wang, et al., 2004), PMI, 2013.
4) Risk Monitoring - The final step in Risk management involves monitoring and responding to current and emerging risks (Banaitiene, et al., 2011; Wang, et al., 2004). It is recognized that residual and secondary risk may result after implementing response strategies.

Earlier empirical studies on risk management practice are mainly regarding: perceptions of typical large contractors towards construction risk allocation, and the importance of different risk categories; usage of techniques at different risk management stages of major companies; usage of risk management techniques and barriers to risk management; general contractors' perception on risks and the use of risk management techniques; and contractors' application of various analytical techniques for risk assessment. Other themes relate to various risks perceived by contractors in the construction market; perceptions of risk allocation in the construction industry and practices of using risk management approaches in selected industries (Abu Bakar, et al., 2012; Abu Bakar, et al., 2012; Ahmed, et al., 1999; Bosher, et al., 2007; Douglas & Wildavsky, 1983; Edwards & Bowen, 1998; Tang, et al., 2007; Turskis, et al., 2012; Perera, et al., 2009; Xu, et al., 2012).

Zhang (2011) in a recent review indicated that two schools of thought on risk analysis can be identified. In the first school of thinking risks are considered to objectively exist and be free of people's minds and values. In other words, the risk consequences that usually concern researchers mainly involve negative impacts in a physical sense, such as mortality, health, safety, and the environment, which are actually judged as negative losses by nearly all social groups and in all value systems. Although risk phenomena are sometimes ambiguous and have traces of value processing, strong supporters of this school consider that they are outside of or have been made before risk analysis (Thompson & Dean, 1996). The other school of thinking considers risk as a subjective construction. Risk is not an objective phenomenon but a subjective mental construct of people who are concerned about the development in or political reaction to their experience, circumstances, and encounters (Douglas & Wildavsky, 1983; Wynne, 1992; Zhang, 2011).

A study conducted by Rahman and Kumaraswamy (2002) compared perceptions on both present and preferred risk allocation, including Joint Risk management (JRM) in construction contracts. Their results reinforce previous observations elsewhere of the divergences in perceptions on both present and preferred risk allocation, both within and between different contracting parties. Despite such differences, respondents professed a general enthusiasm towards JRM, irrespective of their contractual or professional affiliation indicative of a perceived trend towards more collaborative and teamwork based working environments (Rahman & Kumaraswamy, 2002).

Financial risk and time risk are the major risks identified in the Malaysian construction industry, in a recent survey. Both types of risks have a considerable impact on project performance in terms of cost, time and quality. Goh and Abdul-Rahman (2013) suggested that a greater improvement in project performance is more likely to be achieved by focusing on the management of these two major risks, rather than by handling a larger number of minor risks. The lack of proper risk management practices is most likely one of the reasons the local construction projects are experiencing schedule and time overruns (Goh & Abdul-Rahman, 2013).

Chileshe and Yirenkyi-Fianko (2011) found significant differences between perceptions of construction professionals regarding the likelihood of occurrence of potential risks in five categories: construction method; price inflation; exceptional weather; ground conditions and site contamination; and poor communication among the project team. Contractors rated 'construction methods' higher than did the clients, and they also rated 'exceptional weather' higher than either the clients or the consultants. On the other hand, consultants rated 'price inflation' higher than the clients.

For the purposes of this study, a total of 30 different types of risks are derived from literature to provide the framework for the identification of perceived significant risks in construction projects (Table 1).

Table 1 Potential risks identified from Literature

No.	Type of Risk	Author					
		Ahmed, et al., (1999)	Rahman & Kumaraswamy, (2002)	Tang, et al., (2007)	Perera, et al., (2009)	Chileshe & Yirenkyi-Fianko, (2011)	Abdul-Rahman, et al., (2012)
1	Failure to meet Project time estimates						✓
2	Failure to meet Project cost estimates				✓		✓
3	Failure to meet Project quality estimates	✓	✓	✓		✓	
4	Political instability	✓				✓	
5	Health & Safety issues	✓	✓	✓	✓		
6	Inadequate or incorrect Architectural and Engineering design details	✓	✓	✓	✓	✓	✓

7	Financial issues / Delays in release of funds from Project Sponsor	✓	✓	✓	✓	✓	✓
8	Failure to identify defects early		✓	✓			
9	Poor quality of materials supplied	✓	✓	✓		✓	✓
10	Equipment failure	✓	✓	✓	✓		✓
11	Adverse weather conditions		✓		✓	✓	
12	Force majeure/ Natural disasters	✓	✓	✓	✓		
13	Inadequate project supervision			✓		✓	✓
14	Inadequate project planning			✓		✓	✓
15	Claims and disputes	✓	✓	✓			✓
16	Incompetence of subcontractor(s)	✓	✓	✓	✓	✓	✓
17	Incompetence of Engineer				✓	✓	
18	Unforeseen site conditions	✓	✓	✓	✓	✓	✓
19	Shortage of skills/ techniques (labour)	✓	✓	✓	✓	✓	✓
20	Poor communication among Project Team members			✓		✓	✓
21	Insufficient technology			✓			✓
22	Poor coordination			✓		✓	✓
23	Delays in acquisition of Building/ Construction Permits and Approvals	✓	✓		✓		
24	Bureaucracy		✓		✓	✓	✓
25	Exchange rate fluctuation and inflation	✓	✓	✓	✓	✓	✓
26	Suppliers and third party delays	✓	✓	✓			
27	Shortage of materials	✓	✓	✓		✓	✓
28	Shortage of appropriate equipment	✓	✓	✓	✓		✓
29	Poor definition of project scope		✓	✓	✓		✓
30	Environmental issues	✓	✓	✓			

METHODOLOGY

The target population of construction stakeholders includes Clients, Contractors, Engineers, Project Managers, Architects, Quantity Surveyors, and Consultants. A targeted sample of 136 stakeholders was randomly selected from the relevant Professional Bodies. These include the Association of Building, Civil Engineering Contractors of Ghana (ABCECG), Ghana Institute of Architects (GIA), Ghana Real Estate Developers Association (GREDA) and the Chartered Institute of Building, Ghana (CIOB).

Primary data was collected through in-person interviews using a structured interview guide. Majority of the questions applied a five point Likert scale which allow for different statistical techniques to be used for analysis of data collected. The questionnaire was divided into 5 parts.

1. The first part focused on the profile of the respondent and collected information on their primary role or profession, years of experience in the construction industry and their employment status (i.e. self employed, employed in privately owned organisation, or employed in a public organisation).

2. The second part of the questionnaire focused on respondents' perception of their level of risk management knowledge and experience. This information is gathered through a Likert scale format. For risk knowledge (1= No knowledge; 2= Beginner; 3= Intermediate; 4= Advanced; 5= Expert) and for risk management experience (1= No experience; 2= Beginner; 3= Intermediate; 4= Advanced; 5= Expert). Information on the level of formalisation of Risk management Systems in respondents' organisation and the adequacy of Risk management Systems in their organisations was also sought.

3. The third part focused on common risk management practices of respondents. These practices derived from literature are listed in Table 2.

Table 2 Risk management practices derived from literature.

Risk Identification	**Risk Response**
Brainstorming sessions	Avoid the risk
Use of industrial check lists	Reduce the likelihood of occurrence
Consulting experts	Reduce the consequences
Analysis of historical data of similar projects	Transfer the risk
Ad hoc Risk Identification when needed by Project Team	Retain the risk
	Ad hoc Risk Response when needed by Project Team
Risk Analysis	**Risk Monitoring**
Qualitative analysis	Periodic document reviews
Semi-quantitative analysis	Periodic risk status reporting
Quantitative analysis	Periodic trend reporting
Consulting experts	Ad hoc Risk Monitoring when needed by Project Team
Joint evaluation by key project participants	
Use of computers and other modelling	
Ad hoc Risk Assessment when needed by Project Team	

Respondents were requested to rate their usage of these techniques on a Likert scale (1= Never used; 2= Seldom used; 3= Sometimes used; 4= Often used; 5= Always used).

4. Part four collected information on risks respondents considered important or significant in their Risk management considerations. These 30 possible risks were derived from Literature and depicted in Table1. Respondents had to rate various risk events on a Likert scale (1= No importance; 2= Low importance; 3= Medium importance; 4= High importance; 5= Critically important).

Data collected was analysed using the Statistical Package for Social Science (IBM SPSS Statistics 20). The selected techniques that were appropriate for this study include: descriptive statistics, ranking, analysis of variance and correlation tests.

Discussion Of Findings

A total of 136 interviews were conducted. The distribution among the various stakeholders is 5 (Clients); 25 (Contractors); 27 (Project Managers); 11 (Architects); 6 (Planners); 16 (Quantity Surveyors); 8 (Construction Managers); 16 (Site Managers); 13 (Consultants); and 9 (other construction professions). A large majority of respondents (79 respondents) representing 56%, were employed in privately owned organisations whereas 34 respondents (25%) were self-employed and 26 (19%) were employed in public organisations.

A total of 59 (39%) respondents were in senior management positions in their organisations; 41 (30%) in management; 40 (29%) in middle level; and 2 (2%) at lower Levels. This distribution indicates that the vast majority of our respondents are in Senior Management in their organisations making them privy to essential information sought for this study. The following subsections discuss the findings based on the questions in the interview guide.

Risk management Knowledge

Mean values for risk management knowledge was Architects (4.18), Clients (3.80), Construction Managers (3.75), Project Managers (3.70), Planners (3.67), and Contractors (3.64). It is interesting to note that Architects have the highest perception of their risk management knowledge followed by Clients and Construction Managers. One would have expected Project Managers to have the highest knowledge of Risk management on projects by virtue by their position and responsibilities on construction projects. Overall, (mean=3.55) respondents generally perceived they have intermediate level knowledge of risk management.

The overall mean for Risk management experience was 3.58 and for Project Managers, 3.67. This suggests that project managers mostly believe they have Intermediate experience in Risk management (See Table 3). Furthermore, the mean for number of years of construction work experience for Project Managers was 1.44 (translating to 5 to 10 years of experience). It is reasonable therefore to believe that the average Project Manager in our sample has limited construction working experience when compared to other professionals in the study and therefore has intermediate knowledge and experience in Risk management.

ANOVA tests on risk management proficiency among the various respondent groups indicated that there is no significant interaction between knowledge and experience in risk management among the respondents (See Table 4). That is, the differences between the respondents are consistent for knowledge and experience in Risk management.

Correlation tests on risk management proficiency (knowledge and experience) indicated that there is a significant positive relationship between the knowledge of risk management and experience in risk management (See Table 5). This means that, the more experience a respondent has in his field of expertise, the higher his knowledge level of risk management.

Risk management practices

Results from the data analysis as shown in Table 6 indicate that Project Managers and Consultants rank expert knowledge (captioned "Consulting experts') as their most frequently used Risk Identification practice, whereas Clients, Contractors, Architects, and Site Managers rank 'Brainstorming sessions' as their frequently used practice. This insight makes sense since effective risk management requires collaboration and information sharing especially in identifying potential risks on a project. It seems, therefore, that construction professionals in take Risk management seriously and do not necessarily wait until a risk event occurs before action is taken. In other words, reliance on expert knowledge or experience is an indication or proactive rather than a reactive approach to risk management.

Project Managers, Clients, Contractors, and Quantity surveyors rank 'Joint evaluation by key project participants' as their most frequently used Risk Analysis practice (Table 7). This practice involves joint consultation and evaluation of identified risk events to determine their probability and impact. Overall, 'Consulting experts' is ranked first and 'Joint evaluation by key project participants' second. It seems therefore that construction stakeholders perceive risk analysis as team effort. It supports views that Project Management is successful through teamwork and more so risk management should be addressed by a team of experts.

It is interesting to note that Project Managers are the only respondents who rank 'Transfer risk' as their most practiced Risk Response strategy whereas 'Reduce the likelihood of occurrence' is ranked first overall (Table 8). It is conceivable that Project Managers in take a very measured approach to risk response. Contractors prefer 'Reduce the consequences' representing their major concerns with construction. The least preferred Risk Response strategy was 'Retain the risk.' This also indicates that Ghanaian construction professionals would rather reduce the likelihood of a risk occurring than retain it and face the sometimes high consequences.

Project Managers rank 'Periodic status reporting' as their most practiced risk monitoring strategy whereas Contractors, Construction Managers, Planners, Quantity Surveyors and Clients rank 'Periodic document reviews' as their most used practice. 'Periodic trend reporting' is ranked first overall (Table 9).

Potential risks

Respondents were asked to indicate rate risk the importance of 30 risks on their projects. Overall, 'Financial issues' was ranked first indicating a usual trend in construction where financial issues dominate discussions and potential risks (Goh & Abdul-Rahman, 2013). This is followed by 'Inadequate or incorrect Architectural and Engineering design details' (2^{nd}); 'Poor quality of materials supplied' (3^{rd}); 'Failure to meet Project quality estimates' (4^{th}); and 'Failure to meet Project cost estimates' (5^{th}). Furthermore, 'Incompetence of Engineer;' 'Shortage of materials;' 'Health and Safety issues;' 'Failure to meet Project time estimates;' and 'Exchange rate fluctuation and inflation' were ranked 6^{th} to 10^{th} respectively (Table 10). These perceptions confirm earlier studies that indicate that the Ghanaian construction industry is beset with numerous technical and non-technical challenges (Ofori, 2006; Ahadzie & Amoa-Mensah, 2010). The majority of these challenges can be related to the poor skills and training of many construction workers. It is no wonder that respondents perceive that materials supplied for their construction works are very likely to be of poor quality or in short supply, either because the supplier is unskilled or is deliberately cutting corners. Again, 'Incompetence of Engineer' is even ranked second by Project Managers and Architects, meaning that in their view, it is highly possible to have and incompetent Engineer on a construction project as far as risk management is concerned.

On the other hand, Project Managers and Contractors ranked 'Health and Safety issues' as their most important risk consideration followed by 'Incompetence of Engineer' and 'Poor definition of scope' (second). This is a clear indication of the level of importance associated with safety on construction sites.

Interestingly, Clients from the study perceived 'Failure to meet Project quality estimates' and 'Suppliers and third party delays' as their most critically important risk consideration in contrast to perceptions of Project Managers and Contractors discussed earlier. Clients go further to rank 'Failure to meet Project time estimates,' 'Failure to meet Project cost estimates,' 'Incompetence of subcontractor(s),' 'Poor communication among Project Team members,' and 'Exchange rate fluctuation and inflation' 3^{rd} (means=4.80). These perceptions are consistent with the general expectations of clients who are concerned with risks that can affect the timely delivery of their projects.

Table 3 Respondents' risk management knowledge

Risk management proficiency	Total		Client		Contractor		Project Manager		Architect		Planner		Quantity Surveyor		Construction Manager		Site Manager		Consultant	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Knowledge of Risk management processes in construction?	3.55	.815	3.80	.837	3.64	.638	3.70	.609	4.18	.603	3.67	.816	3.19	.981	3.75	.707	3.00	1.033	3.85	.555
Experience in Risk management	3.58	.736	3.80	.837	3.64	.757	3.67	.555	3.91	.302	3.50	.837	3.25	.775	4.00	.535	3.25	1.065	3.85	.555
Level of formalization of Risk management Systems in respondents organization	3.59	.851	2.80	1.304	3.67	.761	3.59	.971	4.18	.603	3.83	.408	3.50	.816	3.71	.488	3.06	.929	3.69	.751
Level of adequacy of Risk management Systems in respondents' organization	3.84	.809	4.20	.447	3.84	.800	3.89	.751	4.00	.775	3.83	.408	3.75	1.065	3.63	1.061	3.44	.964	4.00	.577

Table 4 ANOVA test for risk management proficiency among the various stakeholders (respondents)

Tests of Between-Subjects Effects					
Dependent Variable: Respondents					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	100.215a	13	7.709	.998	.458
Intercept	673.417	1	673.417	87.177	.000
Knowledge in Risk management	34.227	4	8.557	1.108	.356
Experience in Risk management	4.131	4	1.033	.134	.970
Knowledge in Risk management * Experience in Risk management	18.149	5	3.630	.470	.798
Error	896.062	116	7.725		
Total	3256.000	130			
Corrected Total	996.277	129			
a. R Squared = .101 (Adjusted R Squared = .000)					

Table 5 Correlation results for risk management proficiency (knowledge and experience)

Correlations			
		Knowledge of Risk management	**Experience in Risk management**
Knowledge of Risk management	Pearson Correlation	1	**.747****
	Sig. (2-tailed)		.000
	N	130	130
Experience in Risk management	Pearson Correlation	.747**	1
	Sig. (2-tailed)	.000	
	N	130	130
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 6 Risk Identification practices

Risk Identification practices	Overall		Client		Contractor		Project Manager		Architect		Planner		Quantity Surveyor		Construction Manager		Site Manager		Consul
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean
Brainstorming sessions	3.71	1	4.00	2	3.72	1	3.74	2	4.18	1	3.33	3	3.44	3	3.71	2	3.67	1	4.00
Use of industrial checklists	3.35	4	3.80	3	3.20	5	3.62	4	4.00	3	3.33	3	2.88	6	3.14	5	3.40	3	3.25
Consulting experts on Risk identification	3.63	2	3.20	5	3.56	3	3.77	1	3.73	4	3.50	2	3.63	2	3.50	3	3.53	2	4.15
Analysis of historical data of similar projects	3.56	3	3.60	4	3.72	1	3.65	3	3.27	6	4.17	1	3.81	1	3.86	1	2.87	6	3.46
Ad hoc Risk identification when needed by Project Team	3.25	6	3.20	5	3.04	6	3.38	5	3.50	5	3.17	5	2.94	5	3.14	5	2.93	5	3.54
Other	3.31	5	4.67	1	3.38	4	3.00	6	4.00	2	3.00	6	3.20	4	3.33	4	3.29	4	3.00

Table 7 Risk Analysis practices

Risk Analysis practices	Overall		Client		Contractor		Project Manager		Architect		Planner		Quantity Surveyor		Construction Manager		Site Manager		Consultan	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	R
Qualitative analysis	3.56	5	3.40	4	3.79	2	3.74	5	4.00	3	3.50	5	3.56	4	3.14	5	3.27	4	3.54	4
Semi-quantitative analysis	3.15	8	2.80	7	3.17	8	3.08	8	3.80	6	3.00	7	3.50	6	3.00	7	2.73	8	3.08	8
Quantitative analysis	3.61	4	4.00	1	3.61	4	3.85	3	3.82	5	3.17	6	3.88	2	3.29	4	3.20	6	3.38	6
Consulting experts on Risk analysis	3.90	1	3.40	4	3.76	3	3.78	4	3.73	7	3.67	4	3.56	4	3.63	2	5.47	1	3.83	2
Joint evaluation by key project participants	3.86	2	4.00	1	3.84	1	4.04	1	4.00	3	3.83	2	4.00	1	3.86	1	3.53	2	3.92	1
Use of computers and other modeling	3.65	3	2.80	7	3.56	5	3.93	2	4.00	2	4.00	1	3.81	3	3.57	3	3.20	5	3.54	4
Ad hoc Risk assessment when needed by Project Team	3.35	6	3.00	6	3.24	7	3.41	7	3.55	8	3.83	2	2.81	7	3.14	5	3.33	3	3.64	3
Other	3.21	7	3.67	3	3.25	6	3.44	6	4.33	1	2.00	8	2.17	8	3.00	8	2.83	7	3.20	7

Table 8 Risk Response practices

Risk Response practices	Overall		Client		Contractor		Project Manager		Architect		Planner		Quantity Surveyor		Construction Manager		Site Manager		Consulta	
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	
Avoiding the risk	4.01	2	3.20	5	4.16	3	4.19	2	3.82	5	4.17	1	3.75	3	4.17	1	3.80	2	4.08	
Reduce the likelihood of occurrence	4.16	1	4.20	1	4.17	2	4.19	3	4.09	2	3.83	2	4.13	1	4.00	2	3.93	1	4.23	
Reduce the consequences	3.95	3	3.60	2	4.23	1	3.92	4	3.91	4	3.83	2	3.93	2	4.00	2	3.60	3	3.92	
Transfer the risk	3.19	6	3.60	2	2.83	6	5.19	1	2.82	6	2.50	6	2.75	4	2.00	7	2.43	6	2.54	
Retain the risk	2.37	7	1.80	7	2.63	7	2.73	7	2.55	7	2.00	7	1.81	7	2.67	6	2.29	7	2.46	
Ad hoc response when needed by Project Team	3.36	4	2.80	6	3.61	4	3.58	5	3.91	3	3.00	4	2.53	6	3.20	5	3.13	4	3.46	
Other	3.29	5	3.33	4	3.22	5	3.25	6	4.20	1	3.00	4	2.67	5	3.67	4	3.13	5	3.00	

Table 9 Risk Monitoring practices

Risk Monitoring practices	Overall		Client		Contractor		Project Manager		Architect		Planner		Quantity Surveyor		Construction Manager		Site Manager		Co
	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Me
Periodic document reviews	3.82	2	4.80	1	4.13	1	3.65	2	4.18	2	3.67	1	3.75	1	4.00	1	3.47	1	3.4
Periodic status reporting	3.70	3	4.40	2	4.04	2	3.77	1	3.91	4	3.50	2	3.50	3	3.71	2	3.40	2	3.0
Periodic trend reporting	3.90	1	4.20	3	3.75	3	3.62	3	4.00	3	3.33	3	3.44	4	2.83	4	3.20	4	3.0
Ad hoc Risk monitoring when needed by Project Team	3.46	4	3.40	4	3.54	4	3.62	4	3.64	5	3.33	3	2.81	5	3.50	3	3.40	2	3.4
Other	3.00	5	2.67	5	3.29	5	2.88	5	4.33	1	3.00	5	3.60	2	2.00	5	2.83	5	2.2

Table 10 Potential Risks

Potential Risks		Overall		Client		Contractor		Project Manager		Architect		Planner		Quantity Surveyor		Construction Manager		Site Manager		C
		Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	Mean	Rank	M
1	Failure to meet Project time estimates	4.15	9	4.80	3	4.32	5	4.15	11	4.27	10	4.50	4	4.44	1	3.71	24	3.71	21	4.
2	Failure to meet Project cost estimates	4.23	5	4.80	3	4.36	1	4.22	5	4.00	20	5.00	1	4.38	4	3.86	17	4.21	4	4.
3	Failure to meet Project quality estimates	4.24	4	5.00	1	4.32	4	4.19	8	4.27	9	4.67	2	4.31	7	4.14	7	3.86	18	4.

4	Political instability	3.52	29	3.20	28	3.56	27	3.58	28	3.82	26	3.50	27	3.50	29	3.00	30	3.50	28	4.
5	Health and Safety issues	4.16	8	4.20	18	4.36	1	4.30	1	4.45	2	3.50	27	4.25	11	3.71	24	4.00	13	3.
6	Inadequate or incorrect Architectural and Engineering design details	4.31	2	4.40	12	4.28	6	4.19	8	4.36	4	4.50	4	4.38	5	4.43	2	4.36	2	4.
7	Financial issues	4.35	1	4.60	8	4.36	1	4.22	4	4.27	10	4.67	2	4.44	1	4.57	1	4.43	1	4.
8	Failure to identify defects early	4.08	15	4.40	12	4.08	12	3.96	20	4.18	13	3.67	25	4.13	15	4.29	3	4.21	6	3.
9	Poor quality of materials supplied	4.27	3	4.00	22	4.17	8	4.19	8	4.70	1	4.33	8	4.44	1	4.29	3	4.21	4	4.
10	Equipment failure	3.94	20	4.20	18	3.88	21	3.78	24	4.27	8	3.83	21	3.81	23	3.86	17	4.00	10	4.
11	Adverse weather conditions	3.55	27	3.80	23	3.44	28	3.30	30	3.91	23	3.17	30	3.73	26	3.71	24	3.64	25	3.
12	Force majeure/ Natural disasters	3.49	30	3.20	28	3.44	29	3.41	29	3.64	29	3.67	25	3.94	21	3.71	20	3.36	29	3.
13	Inadequate project supervision	4.02	19	3.80	23	4.00	17	4.11	12	4.36	4	4.33	8	4.00	19	4.00	10	3.64	25	3.
14	Inadequate project planning	4.12	12	4.60	8	4.08	13	4.04	16	4.09	16	4.17	13	4.13	15	4.00	10	4.07	8	4.
15	Claims and disputes	3.81	24	4.40	12	3.68	25	3.63	26	4.18	15	3.33	29	4.31	7	3.43	28	3.64	25	3.
16	Incompetence of subcontractor(s)	4.06	17	4.80	3	4.04	15	4.00	18	4.09	18	3.83	21	4.06	18	4.29	3	3.86	19	4.
17	Incompetence of Engineer	4.20	6	4.60	8	4.12	10	4.22	2	4.45	2	4.17	13	4.31	10	4.29	3	4.00	13	4.

18	Unforeseen site conditions	3.86	23	4.20	18	4.12	11	3.85	23	3.91	24	4.00	18	3.69	27	3.71	20	3.71	22	3.
19	Shortage of skills/ techniques (labour)	3.92	22	3.80	23	3.96	20	4.07	14	3.91	24	4.17	13	4.00	20	4.00	14	3.80	20	3.
20	Poor communication among Project Team members	4.13	11	4.80	3	3.96	19	4.19	7	4.36	4	4.50	4	4.25	11	4.14	7	4.00	10	4.
21	Insufficient technology	3.68	26	3.40	27	3.76	24	3.59	27	3.82	26	4.17	13	3.80	24	3.71	24	3.33	30	3.
22	Poor coordination	4.09	14	4.40	12	4.16	9	4.07	14	4.00	21	4.17	13	3.94	21	4.00	14	4.13	7	4.
23	Delays in the acquisition of Building/ Construction permits and approvals	3.93	21	3.80	23	4.04	14	3.89	22	4.09	16	4.33	8	3.31	30	3.88	16	4.00	10	4.
24	Bureaucracy	3.78	25	4.20	18	3.68	25	3.89	21	3.73	28	3.83	21	3.75	25	3.71	20	3.67	23	3.
25	Exchange rate fluctuation and inflation	4.15	10	4.80	3	4.24	7	4.04	17	4.18	13	4.00	18	4.31	6	4.00	10	3.87	16	4.
26	Suppliers and third party delays	4.10	13	5.00	1	4.04	16	4.11	13	4.00	21	4.00	18	4.19	14	4.14	7	3.87	16	4.
27	Shortage of materials	4.17	7	4.60	8	4.00	18	4.22	5	4.36	4	4.33	8	4.31	7	3.71	20	4.33	3	4.
28	Shortage of appropriate equipment	4.02	18	4.40	12	3.84	23	3.96	19	4.20	12	4.33	8	4.13	15	3.86	19	4.07	9	4.
29	Poor definition of scope	4.07	16	4.40	12	3.84	22	4.22	2	4.09	18	4.50	4	4.25	11	4.00	10	3.87	15	4.
30	Environmental issues	3.54	28	2.60	30	3.16	30	3.78	25	3.64	29	3.83	21	3.63	28	3.43	28	3.67	23	3.

Conclusions

Based on the findings discussed in this study it is reasonable to conclude that:

1. The majority of respondents for this study who are represent Clients, Contractors, Project Managers, Engineers, Architects, Planners, Quantity Surveyor, Construction Managers, Site Managers and Consultants perceive to have Intermediate knowledge and experience of risk management practices in construction which in a sense is good for the industry. Project Managers have on average 5 to 10 years working experience and also an expected intermediate level knowledge of risk management. Architects seem to have advanced level knowledge of risk management and intermediate experience in risk management practices.

2. 'Brainstorming sessions' is the most frequently used risk identification practice by construction professionals in Ghana. This is followed by 'consulting experts' and 'analysis of historical data of similar projects.'

3. Consulting experts is the most frequently used risk analysis practice by construction professionals in Ghana. Joint evaluation by key stakeholders and use of computers and other modelling are also popular.

4. The majority of construction professionals would prefer to 'reduce the likelihood' of a risk occurring. Other professionals would prefer to 'avoid the risk' or 'reduce the consequences.'

5. 'Periodic trend reporting,' 'periodic document reviews' and 'periodic status reporting' are the three most frequently used risk monitoring practices by construction professionals in Ghana.

6. 'Financial issues,' 'Inadequate or incorrect Architectural and Engineering design details,' 'Poor quality of materials supplied,' 'Failure to meet Project quality estimates,' and 'Failure to meet Project cost estimates' are perceived to be the top 5 most important risks to construction projects in Ghana.

7. Project Managers in Ghana perceive 'Health and Safety issues' as their most important risk consideration followed by 'Incompetence of Engineer' and 'Poor definition of scope', 'Financial issues' and 'Failure to meet Project cost estimates'.

Recommendations

Based on the findings of this study, the following recommendations are made for the Ghanaian construction industry:

1. Risk management training is given to more construction professionals so they are better equipped to manage risks that occur in construction projects.

2. Provision is made early on projects to manage prevalent risks such as 'Financial issues,' 'Inadequate or incorrect Architectural and Engineering design details,' and 'Poor quality of materials supplied.'
3. Project Managers should give emphasis to 'Health and Safety issues' on projects to reduce their prevalence on projects.

Biography

Mr. Andrew Hansen-Addy

Mr. Andrew Hansen-Addy holds an MSc in Project Management from the University of Greenwich in London and is currently a Lecturer at the Business School of the Ghana Institute of Management and Public Administration (GIMPA). He teaches courses in Project Management to Undergraduate students at GIMPA. His research interests are in Stakeholder Management, Construction Management, and Risk Management. Prior to getting into academia, Mr Hansen-Addy worked with a number of construction firms and real estate developers in the UK and Ghana.

Professor Edward Fekpe

Prof. Edward Fekpe holds a PhD in transportation engineering with over 30 years of professional experience in transportation engineering practice, project management, research, and education. He is a professional engineer and a certified project management professional (PMP). He is affiliated with many professional associations including the Ghana Institution of Engineers, American Society of Civil Engineers, and Project Management Institute. He is currently the Associate Dean of the Business School of the Ghana Institute of Management and Public Administration (GIMPA). Prof Fekpe has extensive research experience having successfully led and completed several research projects on a wide range of subject.

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