CONSTRUCTION PROFESSIONALS PERCEPTION OF RISK ASSESSSMENT AND MANAGEMENT PRACTICES: DOES LENGTH OF SERVICE IN CONSTRUCTION INDUSTRY MATTER

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This study seeks to investigate the impact of the length of service in the Construction Industry (LSCI) on whether it influences the Construction Professionals perception of the likelihood of occurrence of risk variables within medium to large-sized enterprises (MLEs). A survey conducted in May 2009 of randomly selected samples yield responses from 103 construction professionals drawn from 34 contractors, 46 consultants and 23 clients or owners (private and public) within the Ghanaian construction sector. Response data was subjected to descriptive statistics and subsequently analysis of variance (ANOVA) and other non-parametric tests were also used to examine the differences in the perceptions of the identified 25 risk variables. The descriptive and empirical analysis demonstrated a disparity of the ranking of the risk variables. There was a statistically significant difference at (the $p < 0.05$) in the levels of agreement scores for the 5 of the 25 risk variables of the five different groupings based on the length of experience as follows: (group 1: less than 1 year; group 2: 1-5 years; group 3: 6-10 years; group 4: 11 -15 years; and group 5: more than 15 years) as follows; 'financial failure', 'design changes', 'weather conditions', 'vandalism', and 'local laws'. The less experienced professions (group 1) reported higher scores on the likelihood of occurrence whereas the more experienced professions (group 5) reported fewer score on all the 5 variables. Furthermore, 'financial failure' and 'weather conditions' were the two risk variables having the highest mean scores. The study provides insights on the impact of experience of construction professionals in risk assessment implementation across the Ghanaian construction sector. The Managerial implications to be drawn is that Construction Organizations should be cognisant of the experience of the professions when assessing the likelihood of occurrence of risk variables on construction projects.

Keywords: analysis of variance, Ghana, risk assessment, risk management.

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INTRODUCTION

As a developing country located in West Africa, with a land area of 238,537 square kilometres, and a population of over 23 million people, Ghana has great potential in the construction sector. Ghana through seeking to be the gateway to West Africa and the champion of African excellence, its construction industry has been growing steadily over the years. Given the Ghanaian government's objective in the Ghana Poverty Reduction Strategy (GPRS II) to promote urban infrastructure development and the provision of basic services including increased access to safe, decent and affordable shelter has given the industry a further boost. Despite the important role the industry plays in the nation, the industry is still largely inefficient, especially regarding contract management, as characterized by lengthy payment delays, cost and time overruns and poor project implementation.

The above observation calls for the further exploration into the possible implementation issues of risk assessment and management techniques on construction projects executed in Ghana. For example, how many construction organizations in Ghana currently implement risk assessment and management techniques? To what extent does the length of service in the construction industry influence the perception of the professionals for the likelihood of occurrence? Therefore, as observed and drawing heavily from the Wang and Yuan (2010), and Santoso et al. (2003) approach, the degree of risk needs to be seen both from the probability of occurrence and degree of risk impact. However, it is beyond the scope of this paper to report on the degree of impact, but rather the focus is on whether experience plays a key role in the decision making of risk management practices.

LITERATURE REVIEW

A selection of the studies in developing and developed economies on risk management with emphasis on potential risk events was undertaken and identified from the following literature (e.g. Edwards and Bowen, 1998; Tah and Carr, 2000; Wang et al., 2004; Frimpong et al., 2003; Othman et al., 2006; Dada and Jagboro, 2007; Hassanein and Afify, 2007; Hlaing et al.,2008; Odeyinka et al., 2008; Manelele and Muya, 2008; Aje et al., 2009; and Enshassi et al., 2009). It must be noted that this is by no means exhaustive, however as the context of this study is within, Ghana, Africa, care has been undertaken to include some studies from within the African context, and some examples are also included from the developed (western) economies within the literature review. Verzuh (1999 cited in Manelele and Muya, 2008) states that risks may or may not adversely affect a project, it therefore was important to identify the risks within the context of Ghana. This study collected and compiled twenty five construction project risk related factors drawn from both developing and developed economics and grouped them into 10 categories.

The 25 risk variables as included within the survey document can further be categorized into 'external' and 'internal' key drivers of risks shaping and influencing the building projects within Ghana. These are as follows: External drivers of financial (financial failure' and delay in payment); resources (productivity of labour and plant availability of labour and plant); technical (design changes, and construction methods); economic (poor financial market, inflation, and price fluctuation); environmental (weather conditions, ground conditions and contaminants, and site conditions), government and political (change in government, and change of government policy); security (accidents and injuries, theft on site, and vandalism); and legal (contract laws, and local laws) and 'internal drivers' comprising relationship

(poor communication amongst project team, lack of commitment' and organization and co-ordination), and 'operational' (competence of consultants and contractors, and quality and performance control). The detailed explanations of some of the selected studies with some description of the project threat risks as highlighted in the preceding section and used within this study are summarized discussed within the following sub sections. For example the social risks as identified by Edwards and Bowen (1998) included criminal acts, civil torts, and substance abuse, whereas the political risks include war, civil disorder, and industrial relations. These political risks can arise from the change in government, whether through democratic processes or not. Lester (2007), argues that internal politics inevitably occurs in all organizations and these manifest themselves in different stakeholder's opinions and attitudes in the organization. Economical drivers also affect the building projects. Lowe (1987) in his study of cash flow and the construction client identified inflation and interest rates among the economic factors. Salifu *et al.* (2007) also identified exchange rate variability as a source of cash flow risk.

RESEARCH METHOD

To investigate the impact of the length of service in the Construction Industry (LSCI) on whether it influences the Construction Profession's perception of the likelihood of occurrence of risk variables within medium to large-sized enterprises (MLEs), the following research methodology was employed in the study.

Instrument

The questionnaire was divided into five sections as follows: (1) general demographics of the respondents; (2) risk assessment and management processes; (3) awareness of risk assessment and management processes; (4) barriers to use of risk management techniques; and (5) critical success factors. The results presented here and discussed relate only to the first and second sections of the questionnaire as it is beyond the scope of this paper to report on all the issues that were covered within the research project.

The results of the survey as presented were then analysed in this paper to examine.

1. The degree by which the risk factors were likely to occur on construction projects.
2. The differences in the perceptions of the respondent sub-groups according to the length of service in the construction industry (experienced versus less experienced) for the likelihood of occurrence of risk factors on construction projects.

The questionnaire listed 25 risk variables identified from literature and respondents were then invited to indicate their levels of rating according to the extent the risk variables were likely to occur on construction projects.

Pilot Survey

To fit into the Ghanaian construction conditions, a pilot survey using an embedded e-mail survey because of its notable benefits (Dommeyer and Moriarty, 2000) were administered to 20 professionals in the construction industry in Ghana around March / April 2009. The professionals were asked to examine the questions, try answering them and make inputs. Less than half of the professionals responded but the few made very constructive suggestions and corrections. The necessary corrections were made to the questionnaires before they were finally administered in Ghana. Piloting is

necessary as it is very difficult to predict how respondents will interpret and react to questions (Gill and Johnson 1991).

Survey Administration

The final questionnaires were firstly sent to the Ministry of Water Resources, Works and Housing in Ghana for forwarding to the relevant construction organizations in May 2009. The targeted respondents were drawn using random sampling from a list of all registered construction related firms operating within the Greater Region of Accra (Ghana) which was obtained from the Ministries, Regulatory bodies and Institutions that the various organizations are registered with such as the Ministry of Roads and Transport, Ministry of Water Resources, Works and Housing, Ministry of Highways, Ghana Institute of Architects (GIA), amongst others. A total of 180 questionnaires were sent out using the random sampling technique which ensures bias is not introduced, and 114 were returned, however 11 were rejected as they were not completely filled out, thus only 103 were included in the analysis representing 57 per cent response rate. This is also similar to a survey conducted by Tuuli *et al.* (2007) among a similar sample frame and drew a response rate of 54 percent. The response rate was therefore deemed adequate for the purpose of data analysis. Akintoye and Fitzgerald (2000 cited in Odeyinka *et al.*, 2008) argue that this is way above the norm of 20-30 percent response rate in most postal questionnaire of the construction industry.

STATISTICAL METHODS

The primary focus of the study presented in this paper was to investigate the impact of the length of service in the Construction Industry (LSCI) on whether it influences the Construction Profession's perception of the likelihood of occurrence of risk variables within medium to large-sized enterprises (MLEs),. *Statistical Package for Social Sciences* (SPSS Release 17.0.0) computer programme was used to analyse the data generated by the research questions. The analysis of the data consisted of descriptive statistics to depict the frequency distribution and central tendency of responses to fixed response questions. A 4-point Likert scale on a four-point Likert rating scale (very high = 4, high = 3, low = 2 and very low = 1). A ratio from a difference of 1-4 (3) was used to discuss the degree of central tendency and the following results occur: very low ($\geq 1.00 \leq 1.60$); low ($1.60 \leq 2.40$); high ($2.40 \leq 3.20$); and very high ($3.20 \leq 4.00$).

Therefore, the main hypothesis proposed is.

Null hypothesis: H_0: There are insignificant differences among the perceptions of the construction professions according to the length of experience in the construction industry (less experienced and experienced) for the likelihood of occurrence of the risk factors on construction projects.
Alternative hypothesis: H_1: There are significant differences among the perceptions of the construction professions according to the length of experience in the construction industry (less experienced and experienced) for the likelihood of occurrence of the risk factors on construction projects.

SURVEY RESULTS AND DISCUSSION

Table 1 provides background of research respondents according to their length of service in the construction industry (number of years). As can be observed from Table 1.0, the majority (39%) of the respondents had worked for 1-5 years; 35% worked

for more than 15 years followed by 6-10 yrs (17%); 11-15 (9%) and only a minority (3%) had worked for less than a year.

Table 1: Description of respondents

Length of service in Construction Industry	Frequency	%	Cumulative
Less than 1 year	3	2.90	2.90
1-5	40	38.80	41.70
6-10	18	17.50	59.20
11-15	8	7.80	67.00
More than 15	34	33.00	100.0
Subtotal	**103**	100.0	

This is because the number of graduates produced by the universities each year has increased. Those with less than one year experience were the least because organizations are not able to employ a lot of graduates. The importance of ascertaining the construction experience and professional background of the respondents is due to the varying perceptions of risks as established by Wang and Yuan (2010) who found that factors such as early experience and education background (among others) led decision makers to percieve risk differently. The profile of the respondents according to the industry sector is shown in Table 2.

Table 2: Organization size (number of employees) of respondents

Characterization of the respondents (n = 103)	**Frequency**	**%**	**Cumulative**
Sector of respondents organization			
Contractor	34	33.0	33.0
Consultant	46	45.0	78.0
Client (private and public)	23	22.0	100.0

Some demographics relative to the organization were also collected. The majority (82.52%) of the respondents were medium to large firms with more than 20 employees. The classification of organizations adopted is that by Ghana Statistic Service (GSS), which considers firms with less than 10 employees as small scale enterprise and those with more than 10 as medium to large enterprises. The specific breakdown according to the number of employees was 17 (16.50%) in the 25 to 49 category; 16 (15.53%) in the 50-99 band; 15 (14.56%) in the 100- 199 band; 11 (10.68%) in the 200-300 band and 26 (25.25%) with more than 300 employees. only 18 (17.48%) of the respondents had less than 25 employees. Examination of Table 2 indicates that the majority (45.0%) of the respondents were drawn from the consulting organizations.

Professional background of respondents

Table 3 provides the profile of the respondents according to the professional background.

Table 3: *Professional profile of respondents*

Profession (n = 103)	**Frequency**	**%**	**Cumulative**
Quantity surveyor	32	31.07	31.07
Engineer	33	32.03	63.10
Project manager	22	21.36	84.46
Architect	11	10.68	95.14
Site manager	15	4.86	**100.0**
Total	**103**	**100.0**	

From a professional background viewpoint, nearly the majority with nearly an equal number of the respondents were 32 (31.7%) Quantity Surveyors and 33 (32.03%)

Engineers. The background of the respondents supports the notion that they were involved with running of projects at both operational and strategic levels, therefore had some knowledge of issues related to risk assessment and management practices. This also enhances the internal data validity (Bing *et al.,* 2005). In order to ascertain the classification of organizations into medium and large sized, respondents were asked to indicate their number of employees.

Impact of Length of Service in Construction Industry on Risk Occurrence Perceptions

In order to investigate the impact of the length of service in the Construction Industry (LSCI) on whether it influences the Construction Profession's perception of the likelihood of occurrence of risk variables, a one-way between-groups analysis of variance was conducted. Respondents (subjects) were divided according to their experience as follows: (group 1: less than 1 year; group 2: 1-5 years; group 3: 6-10 years; group 4: 11 -15 years; and group 5: more than 15 years). The significance level of the analysis was set at a *p*-value of 0.05. Table 4 summarizes the results of the ANOVA. Descriptive statistics comprising the means and rankings for the twenty five risk variables for the overall sample and sub-groupings (according to length of service) are also shown in Table 4. It is evident that the differences are only significant for only 4 out of 25 risk factors, namely 'financial failure' ($F = 2.861$, $p = 0.027 < 0.05$), 'weather conditions'($F = 2.685$, $p = 0.036 < 0.05$), 'vandalism' ($F = 2.962$, $p = 0.023 < 0.05$), and 'local laws' ($F = 2.492$, $p = 0.048 < 0.05$). It cannot be concluded to reject the null hypothesis. Odeyinka *et al.* (2008) used the same approach in accepting the null hypothesis where only 1 variables out of 26 was significant.

Using the critically cut off point of 2.40 on a 1-4 Likert scale as described within the methodological section; the first 11 risk factors with overall mean scores of 2.40 and over have demonstrated to have a likelihood of occurrence on construction projects (Table 4, second column). The risk factors with critical impacts are: price flucuations, delay in payment, inflation, quality performance and control, poor financial markets, change of government, comptence of contractors, financial failure, availability of labour and plant, change of government policy and design changes.

Examination of Table 4 also reveals that the risk factors ranking low, and therefore least considered to have any likelihood of occurrence are "contract flaws" (overall mean score = 1.86, rank = 23rd), "local laws" (overall mean score = 1.75, rank = 24th), and "vandalism" (overall mean score = 1.51, rank = 25th). This is consistent with literature as Agyakwa-Baah (2009) observed, in Ghana bespoke contracts are not widely used and because standard contracts are used, contract flaws are not very prevalent. This is also an interesting development considering that, within this study, the majority of the construction professional respondents, irrespective of their length of experience worked for client, and in this case, mostly government institutions. Relative to vanadalism, although very destructive, it does not generally occur on sites in Ghana as identified by Agyakwa-Baah (2009).

The following sub section now dicusses the top four most important risk factors agreed by the different sub-grouping of respondents according to the length of experience as most likely to have a high likelihood of occurrence on construction projects (see Table 4) as follows: (1) price flucuations, (2) delay in payment, (3) inflation, and (4) quality performance and control.

Table 4: Sub-respondents perceptions of the likelihood of occurrence of risk factors on construction projects.

Risk Factor (RF)	Full Sample		Less than 1 Year		1 – 5 Years		6 – 10 Years		11 – 15 Years		More than 15 Years		ANOVA Statistics		Significant Difference (Yes/No)
	Overall $MS^{1,a}$	R	MS^1	R	MS^1	R	MS^1	R	MS^1	R	MS^1	R	F *Stat*	(*p* values)	
Financial Failure	**2.51**	8	3.67	=1	2.63	9	2.06	=18	2.25	17	2.38	9	2.861	**.027***	**Yes**
Delay in Payment	**3.01**	2	3.33	=3	3.03	3	2.94	3	3.00	4	3.03	1	.168	.954	No
Productivity of Labour and Plant	2.34	12	2.67	=8	2.38	14	2.33	12	2.00	21	2.38	7	.516	.724	No
Availability of Labour and Plant	**2.49**	9	2.33	18	2.55	11	2.50	=5	2.38	=14	2.38	8	.214	.930	No
Defective Material and Material Shortage	2.26	14	2.00	=19	2.33	15	2.06	=18	2.63	6	2.24	12	.837	.505	No
Design Changes	**2.45**	11	3.33	=3	2.68	7	2.39	11	2.38	=14	2.15	15	2.288	.065	No
Construction Methods	2.20	17	2.33	=9	2.18	21	2.11	=14	2.50	9	2.21	13	.327	.859	No
Poor Financial Market	**2.55**	5	2.33	=9	2.48	12	2.50	=5	2.63	=7	2.68	4	.593	.668	No
Inflation	**2.98**	3	3.00	=7	3.05	2	2.94	2	2.89	5	2.94	3	.092	.985	No
Price Fluctuation	**3.07**	1	3.00	=6	3.00	4	3.28	1	3.13	3	3.03	2	.405	.805	No
Weather Condition	2.30	15	3.67	=1	3.23	1	2.28	13	2.63	=7	2.21	14	2.685	**.036***	**Yes**
Ground Condition and Contaminants	2.13	20	2.00	=19	2.28	17	1.94	21	2.00	22	2.09	18	.650	.628	No
Site Conditions	2.07	22	2.33	=9	2.13	22	1.89	22	2.50	10	1.97	21	1.279	.284	No
Competence of Consultants and Contractors	**2.54**	7	2.00	=19	2.73	6	2.44	=8	2.38	16	2.47	6	.706	.590	No
Quality and Performance Control	**2.66**	4	2.33	=9	2.85	5	2.61	4	2.38	=12	2.56	5	1.249	.296	No
Change of Government	**2.55**	6	2.00	=19	2.65	8	2.44	=8	3.25	=1	2.36	=10	1.649	.168	No
Change of Government Policy	**2.47**	10	2.33	=9	2.58	10	2.11	16	3.25	=1	2.36	=10	1.966	.106	No
Poor Communication Amongst Project Team	2.22	16	1.67	25	2.30	16	2.44	=8	2.50	11	2.00	19	1.167	.330	No
Lack of Commitment	2.08	21	2.00	=19	2.23	20	2.06	17	2.13	20	1.91	22	.613	.655	No
Organisation and Co-ordination	2.31	14	3.33	5	2.28	18	2.50	=5	2.38	=12	2.15	16	1.735	.148	No
Accidents and Injuries	2.15	19	2.33	=9	2.25	19	2.11	=14	2.25	18	2.00	20	.324	.861	No
Theft on Site	2.22	18	2.33	=9	2.43	13	2.06	20	2.13	19	2.09	17	.965	.430	No
Vandalism	1.51	25	2.67	=6	1.55	25	1.28	25	1.75	23	1.44	25	2.962	**.023***	**Yes**
Contract Flaws	1.86	23	2.00	=19	2.03	23	1.78	23	1.63	=25	1.76	23	.600	.664	No
Local Laws	1.75	24	2.33	=9	1.98	24	1.67	24	1.63	=25	1.50	24	2.492	**.048***	**Yes**

Note: MS^1 = Mean score of the risk variable where 4 = Very High; 3 = High; 2 ; Low and 1 = Very Low; [a] Mean score in bold denotes values above the criticality point of 2.40; R = Ranking of Risk Factor * Significant difference at 95 percent confidence level ($p = < 0.05$)

Price fluctuation

The most important risk factor in Table 4 which was given by the respondents as the most likely to have a high degree of occurrence was price fluctuation. This was ranked

sixth by the less experienced group (mean score = 3.00) whereas the third (6-10 years) and fifth group (more than 15 years) of more experienced constructional professionals ranked it first (mean score = 3.28) and second (mean score = 3.03) respectively. The price fluctuation risk variable is closely aligned with the inflation variable within the composite economic risk factor. As observed by Frimpong *et al.* (2003) and Agyakwa-Baah, (2009), the present economic crisis contribute to fluctuation. Accordingly, this has led to local organizations gradually dying out because foreign organizations (contractors) carry out almost all the project leaving a few or local organizations. This finding is supported by Assibey-Mensah (2008) observation that over the years, the country's indigenous coustruction firms have had to compete unsuccessfully for construction contractors with large, well-equipped, and well-managed foreign construction businesses.

Delay in payment

The mean score for this risk factor ranged from 2.94 (6 -10 years group) to 3.33 (less than 1 year) according to the five sub-groups ranked delay in payment first. This finding is consistent with literature in developing countries (Frimpong *et al.*, 2003; Adams, 2008) As observed by Rameezdeen and Ramachandra (2008); the construction industry has always been closely related to the national economy. Adams (2008) provides further evidence within the Ghanaian context by stating that payment delays on the government stifles progress on projects. Frimpong *et al.*, (2003) also identify bureaucracy in Ghanaian government departments as a contributory factor coupled with the nature of the funding of projects which could either be through domestic savings or foreign funding. Similar studies such as Adams (2004), revealed that delay in payment is the most important factor that brings about project delay. Unfortunately for most construction organizations, the Government is the main client of the industry and avoiding their projects means fighting for the few projects brought in by the private sector. There is so much bureaucracy in the Government agencies that it takes ages for certificates to be issued for payments. In additional, Addo-Abedi (1999 cited in Tuuli *et al.*, 2007) observed that there is no form of compensation to contractors.

Inflation

The third most ranked risk variable likely to have a likelihood of occurrence on construction projects was inflation. This was ranked second by both the construction professionals within the 1-5 years and 6-10 years sub groupings. Interesting the more experienced group (> 15 years) ranked it third with a mean score of 2.94. This finding is also consistent with literature in developing economics as Agyakwa-Baah (2007; 2009), Frimpong *et al.* (2003) studies within the Ghanaian context and that of Denini (2007) within the Libyan construction sector attributed inflation as one cause of project delays which is linked to risk analysis. This can be attributed to a number of challenges faced by the construction industry given the present economic crisis such as the recent global recession. For example, as at June 2009, inflation had risen to 20.74% which is extremely high. The interest rate in Ghana is extremely high and that also deters some foreign investors from coming into the system to invest. As observed by Frimpong *et al.* (2003), the inflation is probably due to demand exceeding supply, which creates scarcity of goods and hence the prices of materials increase.

Quality and performance

Quality and performance control was ranked fourth based on the overall sample score. However as observed by Agyakwa-Baah, (2009), at times specifications from clients are not adequate and contractors are seeking to make a profit also comprise by using

low quality materials. Corruption is another reason attributable to lack of quality and performance control (Agyakwa-Baah, (2009).

SUMMARY, CONCLUSIONS AND IMPLICATIONS

This paper presented part of the MSc dissertation study which sought to investigate aspect of risk assessment and management practices (RAMP) deployment among the medium and large sized enterprises (MLE's) within the Ghanaian construction sector. This involved a questionnaire survey of clients (both public and private), contractors and consultants involved with construction projects. In this study, 25 risk factors likely to occur on construction projects in Ghana were identified. 11 factors are found with an overall mean value above 2.40 which are perceived as likely to occur on construction projects, and thus deemed important.

Key findings from the survey include the most important risk factors agreed by the different sub-grouping of respondents according to the length of experience as most likely to have a high likelihood of occurrence on construction projects. Analysis of the results showed that there was complete disagreement among the five sub-grouping (according to the length of experience) regarding the ranking of the risk variables. However, there was also complete agreement between more experienced grouping (more than 5 years of experience) on the ranking of the economic risk factor, namely 'price fluctuation' with the second group (6-10 years) reporting slightly higher scores. The research also found complete agreement between the less experienced (less than 5 years) for the likelihood of occurrence of the 'weather' risk variable. It can also be concluded that the ranking and importance of factors are different between the less experienced and more experienced constructional professionals. These findings provide decision making support for different types of construction organizations by deepening their understanding of how varying professionals and their length of experience within the industry assess the likelihood of occurrence of risk variables on construction projects.

Limitations of the study and future research

Interpretation of these findings must consider the following study limitations. This study cannot be generalized statistically for the whole of Ghana as it was constrained geographically, with only respondents drawn although from a random sample of construction organizations in the Greater Accra Region. However, notwithstanding that, as asserted by Chileshe (2004), the findings represent a snapshot of the reality of the impact of experience on the perceptions of the construction professions working with clients, consultants and contractors relative to the likelihood of occurrence of risk. Another important limitation is that this study did not take into account the different classifications of local and foreign contractors. As Adam (2008) demonstrated, perceptions of risks between the two groups tended to vary. This study confirms the applicability of the influence of experience in risk management decision making related issues in a developing economy such as Ghana which is an under-researched area. Owing to this, there is a possibility of bias playing in the outcome of this study. This study should be duplicated in other economics particularly the less developed ones within the African context.

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