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Perceptions of Threat Risk Frequency and Impact on Construction Projects in Ghana: Opinion Survey Findings

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Abstract: Threat risks are experienced by all stakeholders in a construction project. Although the nature of these risks is understood, less is known about their likelihood of occurrence and potential impact. This study explored these elements of risk by using an opinion survey approach to collect data from 103 professionals (clients, consultants and contractors) in the Ghanaian construction industry. Significant differences were found between the perceptions of these sub-groups regarding the likelihood of occurrence of threat risks in five categories: construction method; price inflation; exceptional weather; ground conditions and site contamination; and poor communication among the project team. The 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. Significant differences between the sub-groups were also found regarding the potential impact of the threat risk of price fluctuation. The consultants rated the 'price fluctuation' threat risk higher than either the contractors or the clients. These findings suggest that despite the existence of remedial strategies to protect some of the stakeholders from these risks, there is a fear of being blacklisted, thus compromising future opportunities (especially among contractors) should legal action be taken to redress the identified problems (such as such delayed payments). The following implications are drawn: One of the suggested recourses is the introduction of bespoke rather than standard contracts, as these might introduce contract flaws and contribute towards helping the project stakeholders monitor these potential risks and take appropriate action.

Keywords: Ghana, Construction industry, Project risk factors, Opinion survey

INTRODUCTION

According to Agyakwa-Baah, (2007), in Ghana, risks are dealt with in a completely arbitrary way by adding 10% contingency onto the estimated cost of a project. The importance of the construction industry in Ghana is evidenced by its average revenue flows, which generally represent some 25% of the budget revenue and 6% of Gross Domestic (GDP) (Agyakwa-Baah et al., 2010). The contribution of the construction industry is also noted in many ways. According to Akoi-Gyebi Adfei (2009), this ranges from the direct importation of buildings and components to supplemental domestic production and to the use of design and implementation expertise provided by foreign consultants and contractors. Other

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areas of contribution are within road transportation, as it is the widely available form of transport in Ghana: it carries in excess of 97% of all passenger and freight traffic. Road transportation links all major cities, towns and villages; it also links agricultural production areas with local, regional and national markets. Governments have therefore been trying to channel abundant funds into the road sector with the goal of maintaining or improving the state of the roads. According to Mills (2001), risk contingencies are a result of past experiences concealed within the bidding process. Mills (2001) furthers states that contingencies protect the contractor's interests in the event that a risk occurs.

The simple use of contingency sums to deal with risk is unlikely to encourage more effective management of projects, nor to lead to greater efficiency in the construction industry. Stakeholders need to have a more comprehensive understanding of the nature of the risks they face, their likelihood of occurrence and their potential impact on the stakeholder's organisation. This study reports on research that investigated client, consultant and contractor perceptions of these risk factors for medium and large enterprises in construction projects in Ghana.

The rest of the study is structured as follows. The following section gives an overview of the state of the construction industry in Ghana. The drivers of keys risks shaping and influencing building projects follows after the overview. The next section summarises and presents brief discussions on the extant literature on risk assessment and impacts on construction projects and a brief discussion of the main risk factors so identified. This is followed by the methodological approach adopted and a discussion of the findings. The implications and conclusions drawn are in the last section.

AN OVERVIEW OF THE GHANAIAN CONSTRUCTION INDUSTRY

Ghana, a developing country in West Africa, was founded some 50 years ago. It is a fledgling democracy with a land area of 238,537 sq km and a population of over 20 million. Ghana seeks to be the gateway to West Africa and the champion of African excellence. Ghana, whose capital is Accra, has 10 regions: Ashanti, Brong Ahafo, Central, Eastern, Greater Accra, Northern, Upper East, Upper West and Volta. Ghana gained its political independence on March 6, 1957 and around that period, its construction industry was dominated by such giant organisations as Taylor Woodrow Company and A Lang Company, among other foreign firms operating in the country (Assibey-Mensah, 2008).

Assibey-Mensah noted that in 1961 the country's own public-sector construction agency, the State Construction Corporation (SCC), was established with

the primary goal of constructing highways, feeder roads, urban roads and so forth in the most cost-effective and efficient manner. The State Construction Corporation (SCC) was successful for many years, but unfortunately it was divested in 1998–1999. Assibey-Mensah (2008) added that the SCC was confronted with many operational bottlenecks, including underestimation of projects and their inability to meet performance targets, which led to increases in government expenditures, making the agency a public liability. According to Ayirebi-Dansoh (2005), in Ghana, the operating environment for construction firms is constantly changing in the face of a volatile economic environment, a shifting political climate and a highly competitive market. The construction industry is directly linked to the Ghanaian economy because the government is the biggest client in the industry (Agyakwa-Baah, 2007; Tuuli et al., 2007). According to Ayirebi-Dansoh (2005), construction firms in Ghana are categorised into four financial classes (1 through 4) according to the size of individual projects they can bid for from the government. Building contractors are designated as D1, D2, D3 or D4 corresponding to the financial classes 1 through 4. There is no financial limit on projects for class 1, whereas those for classes 2, 3 and 4 are US$500,000, US$200,000, and US$750,000, respectively, (Ayirebi-Dansoh, 2005). The construction industry in Ghana has been growing steadily over the years. Akoi-Gyebi Adjei (2009) observes that D1 contractors have demonstrated experience in building and civil engineering works. The Greater Accra region also accounts for about 27.0% of the total number of all persons engaged within all industries. The annual value of public procurement of goods, works and consultant services represents about 10% of Ghana's Gross Domestic Product (GDP) (World Bank, 2003).

Drivers of Risks

Consideration of 'external' and 'internal' risk drivers within the project environment can be viewed as part of strategic planning. The process of strategic planning involves auditing of the external environment. For example, Ayirebi-Dansoh (2005) observed that the operating environment for construction firms in Ghana is constantly changing in the face of a volatile economic environment, a shifting political climate and a highly competitive market. Similar studies such as Ahmed et al. (2007) and Hlaing et al. (2008) have also identified linkages between the economy and procurement methods. Gunderman and Applegate (2005) recommend learning how to balance the possible negative consequences of risk against the potential benefits of its associated opportunity. This, according to Gunderman and Applegate (2005), would provide organisations with an opportunity to progress through risk management. Against this background, some of the drivers of key risks particularly affecting the building projects within Ghana as conceptualised within Figure 1 are discussed.

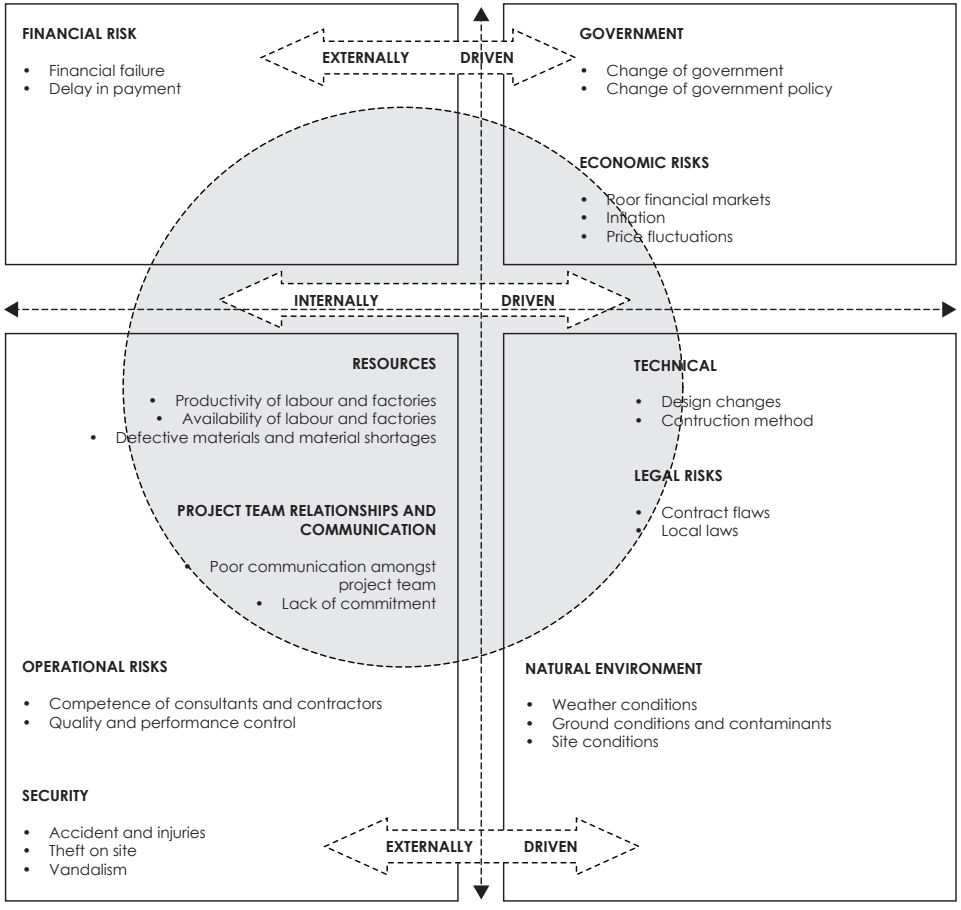

Figure 1. Drivers of Risk

External Drivers of Risk

Financial drivers

Risk drivers from a financial perspective are 'financial failure' and 'delay in payments'. In Ghana, the majority (70%) of construction projects are financed through foreign assistance in the form of bilateral agencies, and the remaining 30% are generated domestically through the road fund (Berko, 2007). However, even though these funds have been targeted for construction projects (such as roads that are given on contract to contractors), there are regular delays in payments to contractors as a result of bureaucracy in government departments, and there are marked delays in the release of funds from donor agencies (Berko, 2007). Within the Ghanaian context, a study by Agyakwa-Baah (2007) on stakeholders' perceptions of causes of delays in construction projects also found that delays in payment are a major cause of delays in construction projects. Hassim et al. (2009) found financial failure to be the most significant risk in their study of contractors within the Malaysian context.

Economic drivers

Among the variables associated with economic risk drivers are poor financial markets, inflation, and price fluctuations, with the notable consequence being project overruns (Agyakwa-Baah, 2007, 2009; Frimpong et al., 2003; Denini, 2009). Cost overruns due to inflation come about as a result of currency instability. Currently, there is stability in the currency; but, even so, the rapid increase in oil prices still keeps project cost overruns very high. A study conducted by Berko (2007) established that between 2001 and 2007, the cost of fuel in Ghana had increased by as much as 280%. The fluctuation in price in one project was about 300% between 2001 and 2007, so one can appreciate the effect of oil hikes. Frimpong et al. (2003) attributes high inflation to demand exceeding supply. The economic drivers used within this study can also be found in the seminal work by Edwards and Bowen (1998). For example, the economic risks categorised by Edwards and Bowen (1998) include material supply, labour supply, equipment availability, inflation, tariffs, fiscal policies, and exchange rates.

Government

In developing countries like Ghana, many roads are competing for attention. Agyakwa-Baah (2009) found that there is, therefore, intense pressure on the government to satisfy the citisenry politically because there is a culture of evaluating the performance of government through the development projects (and especially construction projects) it has been able to undertake during its term of office. Road projects are, therefore, frequently varied by way of additions to satisfy public demand.

Tchankova (2002) observed that the ruling party of a nation can affect organisations in many ways. He added that different ruling systems display different attitudes and policies towards businesses. De la Cruz et al. (2006) lend support to this argument by pointing out that political motivations can influence a project more than other interests. They further argue that these motivations could mean that infrastructure is not planned and constructed in accordance with real needs (De la Cruz et al., 2006). Berko (2007) observed that this political interference is due to cheaper negotiations by governments on development projects that are mostly handled by consultants on behalf of the clients.

Natural environment

Natural environment project risks such as the 'weather' factor are among the weakest drivers influencing the building projects because Ghana does not experience tornados or typhoon seasons but instead has a rainy season and high temperatures. This could be attributed to the fact that Ghana is found in the tropics and, therefore, has two seasons: a dry and a wet season. However, the factors of 'ground conditions and contaminants' and 'site conditions' need consideration. Time limitations established by the client can also prevent the development of an adequate soil report (De la Cruz et al., 2006).

Technical

Ofori (1994) pointed out that technology development requires financial resources, conducive economic conditions, relevant administrative support, a physical infrastructure, organisations that can apply the new technology and a supportive culture. Unfortunately, most of these factors are weak in developing countries. Another major cause of inaccurate design details occurs when the consultants are inexperienced, are not competent or do not have the structure to handle such complex and high-risk projects. A study by Oladapo (2007) found variations to have a significant effect on project cost and time overruns. According to Baxendale and Schofield (1986; cited in Oladapo, 2007), variations may be defined as any change to the basis on which the contract was signed.

Internal Drivers of Risk

Resources

The studies by Agyakwa-Baah (2009) and Berko (2007) established that within Ghana, finding labour for a project is not a problem, but plants and equipment are a major problem for most construction organisations, especially local contractors. Three resource risks are adopted in this study, namely 'productivity of labour and plant', 'availability of labour and plant', and 'defective materials and material shortage'.

Project team relationships and communication

'Positive human dynamics' and 'team work and communication' are closely interrelated as both are vital in managing risks on projects. Furthermore, lack of communication amongst team members is in itself a risk factor. Lester (2007) acknowledged that the relationships stakeholders have with a project can vary from being very supportive to antagonistic, but he added that this needs to be managed effectively so that it does not have any effect on the project. It is essential that communication and team work is encouraged for each project, as communication among the team is crucial to the successful completion of a project. This risk event was selected based on the study by Santoso et al. (2003), which evaluated 130 risk events with group factor analysis and found that poor communication was ranked as a risk event with an above-average impact and likelihood.

SPECIFIC PROJECT RISK FACTORS

A selection of the studies in developing and developed economies on risk management was reviewed. It must be noted that this review is by no means exhaustive; however, as the context of this study is Ghana, Africa, care has been taken to include some studies from within the African context, and some examples are also included from developed (western) economies. Verzuh (1999; cited in Manelele and Muya, 2008) states that risks may or may not adversely affect a project, and therefore it is 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 economies and grouped them into 10 categories. The 10 composite risk factors included within the survey document are: financial; resources; technical; economic; environmental, operational; government and political; relationship; security; and legal. These are shown in Table 1.

Detailed explanations of these studies with a description of the project threat risks as illustrated in Figure 1 and used within this study are summarised and included within Table 1. The authors or researchers and findings of each study are listed in column five. Other studies reviewed but not included within Table 1 and linked to the potential key drivers shaping and influencing building projects in Ghana as illustrated in Figure 1 are briefly discussed in the 'external' and 'internal' drivers of the risk sub-sections.

One of the external key drivers affecting building projects is that of 'Government', which arises as a result of 'change of government' or 'change of government policy'. According to Lester (2007), internal politic struggles inevitably occur in all organisations, and these manifest themselves in different opinions and attitudes among the stakeholder in the organisation.

Table 1. Description and Categorisation of Project Risk by 'Source of Risk' Taxonomy and 'Drivers'

No	Driver	Source of Risk	Description	Researchers and Findings
1	External	Government	• Change of government • Change of government policy	• Edward and Bowen (1998) This study classified risk into two categories (internal and external) with internal risk being further sub-classified into local and global, comprising eight sub-categories in total. External risk was further sub-divided into economic, physical, political and technological change.
2		Economic	• Poor financial markets • Inflation • Price fluctuations	• Dada and Jagboro (2007) Identified the relative importance of risk factors with finance and political influence emerging as main risk factors. • Hlaing et al. (2008) Assessed factors dominating constraints for the implementation of risk and identified the following as having the greatest impact on the financial aspects of the project: lack of financial resources of the contractor; financial stability of the client; and cost overruns due to delay. • Enshassi et al. (2009) Four main causes of time delays: strikes and border closures; material-related factors; lack of materials in markets; and delays in material delivery to the site. Three main causes for cost overruns: price fluctuations of construction materials; contractor delays in materials and equipment delivery; and inflation.
3		Technical	• Design changes • Construction Method	• Wang et al. (2004) Categorised the risk event of unanticipated design changes and errors in design/ drawings at the project level within their proposed three-tiered hierarchical risk management framework for construction projects.
4		Legal	• Contract laws • Local laws	• Odeyinka et al. (2008) Examined contractors' perception of the extent of risk occurrence and impacts on cash flow forecast and identified 11 significant risk factors out of 26 research risk variables.
5		Natural Environment	• Weather conditions • Ground conditions and contaminants • Site conditions	• Othman et al. (2006) Established that construction time performance (CTP) was affected more by variables related to excusable delays than project characteristic variables.

(Continue on next page)

Table 1. *(continued)*

No	Driver	Source of Risk	Description	Researchers and Findings
6	External	Security	• Accidents and injuries • Theft on site • Vandalism	• Tah and Carr (2000) This study classified risk into two categories (internal and external) with internal risk being further sub-classified into local and global comprising eight sub-categories in total. External risk was further sub-divided into economic, physical, political and technological change.
7		Management	• Competence of consultants and contractors • Quality and performance control	• Aje et al. (2009) Contractors' management capability had a significant impact on the cost and time of building projects.
8		Financial	• Financial failure • Delay in payment	• Hassanein and Afify (2007) Developed a checklist of risk categories and identified the following seven as the most significant risks relevant to construction contracts: owner's obligations; interface with other contractors; liability risks; financial risks; risks related to changes; technical risks; and consortium risks.
9	Internal	Resources	• Productivity of labour and factories • Availability of labour and factories • Defective materials and Material shortages	• Frimpong et al. (2003) Identified the main causes of delay and cost overruns including the following: monthly payment difficulties from agencies; poor contractor management; material procurement; poor technical performance; and escalation of material prices
10		Relationship	• Poor communication amongst project team • Lack of commitment • Organisation and co-ordination	• Manelele and Muya (2008) Identified the following six critical risk categories: project initiation; community contribution and participation; budget and finance; skilled labour; materials procurement and technical supervision.

Tchankova (2002) also noted that the ruling party of a nation can affect organisations in many ways. Tchankova (2002) further argues that different ruling systems have different attitudes and policies towards businesses.

Economic drivers also affect building projects. In his study of cash flow and the construction client, Lowe (1987) identified inflation and interest rates among the economic factors. Salifu et al. (2007) identified exchange rate variability as a source of cash flow risk. Financial drivers such as 'financial failure' and 'delay in payments' have been found to affect project performance in terms of cost and time overruns. For example, Dada and Jagboro (2007) in their study of the impact of risk on project performance, identified finance as one of the main risk factors; however, the emphasis of that study was on building procurement. Hassanein and Afify (2007) also identified financial risk as one of the most significant risks relevant to construction contracts in Egypt. In Ghana, a study by Agyakwa-Baah (2007) on stakeholders' perceptions of causes of delays in construction projects found that delay in payment was the major cause of delays on construction projects.

The 'environmental risk factors' illustrated in Figure 1 have been examined in the literature. For example, Wang et al. (2004) ranked environmental protection as the least critical risk that can affect construction projects in China. However, Tchankova (2002) states that the environment's influence on people and people's influence on the environment are very important aspects of this source of environmental risk.

Other external drivers such as 'legal threat risks' as categorised by Edwards and Bowen (1998) to include contract clauses, regulations and codes are a source of external risks to building projects. The study conducted by Tchankova (2002) found that the legal system creates risk by the disparity of current or new environment laws. Figure 1 also identifies 'resources' and 'project team relationships & communications' as internal drivers. The seminal work by Edwards and Bowen (1998) categorised 'managerial risks' to include productivity, quality assurance, cost control, and human resource management issues. Within the context of Ghana, these relate to 'productivity of labour and plant' and 'availability of labour and plant' and do not pose much of a problem (Agyakwa-Baah, 2009). However, in other sub-Saharan countries such as Zambia, incompetent labour as grouped under 'human resource management' was found to affect community projects (Manelele and Muya, 2008). Labour factors such as labour shortage, low productivity, weak skills, labour turnover and poor discipline could be regarded as a source of risk contributing towards construction delays (Lalitan and Loanata, 2010). The second 'internal risk driver' shown in Figure 1 is that of 'relationships'. Tchankova (2002) opines that changes in people's values, human behaviour and the state of society are another source of risk.

However, despite the previous construction project risk classification derived from a cross section of the literature, what is notable from the summary (Table 1) is an obvious omission, particularly within the Ghanaian context, of studies focussed on the identification and assessment of the frequency and impact of risk factors on construction projects in medium and large enterprises. In particular, differences in the perceptions of clients, contractors and consultants regarding the likelihood of occurrence and severity of the impact of risk factors for construction projects within Ghana has remained unexplored. Given the literature review, the following subsection describes the research methodology adopted within this study.

RESEARCH METHODOLOGY

To investigate perceptions of the likelihood of occurrence and severity of risk in construction projects, the following research methodology was employed.

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 the use of risk management techniques; and (5) critical success factors. The results discussed and presented here relate only to the first and second sections of the questionnaire, as this study is extracted from a research project that also examined the critical success factors and barriers to the deployment of risk management. It is beyond the scope of this paper to report on all the issues that were covered within that research project.

The results of the survey were then analysed in this paper to examine:

1. The frequency with which the risk factors were likely to occur and the severity of their impact on construction projects

2. Any differences in the perceptions of the respondent sub-groups (contractors, clients and consultants) regarding the likelihood of occurrence and severity of risk impact on construction projects

The questionnaire listed 25 risk variables identified from the literature, and respondents were then invited to indicate their perception of the likelihood a risk variable would occur and the severity of its impact on a construction project on a four-point Likert rating scale (Very High = 4, High = 3, Low = 2 and Very Low = 1). A scale of 1 – 4 (3) was used to assess the degree of the central tendency: $\geq 1.00 \leq 1.60$ (Very Low); $1.60 \leq 2.40$ (Low); $2.40 \leq 3.20$ (High); and $3.20 \leq 4.00$ (Very High).

Whereas previous studies in risk management have used Likert scales with more than four points [for example, Odeyinka et al. (2008) used a 0 to 5 Likert scale and Ahadzie et al. (2008) used a five-point Likert rating scale], some earlier studies such as Garland (1991) have provided conflicting reasons for including or omitting a mid-point. Against the inclusion of a mid-point, Garland (1991) argued that a respondent's desire to please the interviewer or appear helpful might lead them away from giving what they perceive to be a socially unacceptable answer (Garland, 1991: 4). Drawing from Ahadzie et al. (2008), when two or more criteria have the same mean, the one with the lowest standard deviation is assigned the highest importance ranking. Chileshe (2004) similarly used the coefficient of variation to address the same approach.

Pilot Survey

To fit into the conditions of Ghanaian construction, a pilot study using an embedded e-mail survey, because of its notable benefits (Dommeyer and Moriarty, 2000) and [as mentioned by Jackson and DeCormier (1999)] because it is an inexpensive and efficient means of communicating with clients and customers, was administered to 20 professionals in the construction industry in Ghana around March/April 2009. The professionals were asked to examine the questions, try to answer them and to make input. Less than half of the professionals responded, but those who did made very constructive suggestions and corrections. The necessary corrections were made to the questionnaires before they were ultimately administered in Ghana. Pilot studies are necessary because it is very difficult to predict how respondents will interpret and react to questions (Gill and Johnson, 1991).

Survey Administration

The final questionnaires were first sent to the Ministry of Water Resources, Works and Housing in Ghana for forwarding to the relevant construction organisations in May 2009. The targeted respondents were drawn by random sampling from a list of all registered construction-related firms operating within the Greater Region of Accra (Ghana) obtained from the ministries, regulatory bodies and institutions that the various firms are registered with, such as the Ministry of Roads and Transport; the Ministry of Water Resources, Works and Housing; the Ministry of Highways; and the Ghana Institute of Architects (GIA). Drawing heavily from Akoi-Gyebi Adjei (2009), the snowball sampling technique was utilised to identify clients from the obtained lists. According to Akinson and Flint (2001; cited in Akoi-Gyebi Adjei, 2009), the process of snowballing is based on the underlying assumption that a 'bond' or 'link' exists between the initial sample and others in the target population, allowing a series of referrals to be made within a circle of acquaintance (Akoi-Gyebi Adjei, 2009: 78). To improve the response rate, a number of follow-up procedures and strategies were

considered, such as sending reminder surveys or notices to non-respondents. However, this was not considered to be viable, as Schneider (1985; cited in Dunn and Huss, 2004) observed that increasing the response rate may negatively affect the reliability of the information obtained. That study further states that increased pressure by a researcher on subjects to respond will result in more uninformed responses. To overcome that, a range of measures to improve the response rate based on established principles of reciprocity, social proof, and legitimacy and authority as recommended by Bednar and Westphal (2006) were incorporated within the survey. These included measures such as having a shorter questionnaire (six pages) and, most importantly, reciprocity through promising respondents a summary report of the results of the study.

Because the purposes of this study were descriptive, and the research question involved establishing the opinions of respondents on risk management, the recommended research strategy is that of an analytical survey. To this end, survey questionnaires were used as the data collection technique.

A total of 180 questionnaires were sent out using a random sampling technique, which ensures bias is not introduced. Although 114 were returned, 11 were rejected because they were not completely filled out; thus, only 103 were included in the analysis for a response rate of 57%. This is similar to a survey conducted by Tuuli et al. (2007) among a similar sample that drew a response rate of 54%. The response rate was therefore deemed adequate for the purposes of data analysis. Akintoye and Fitzgerald (2000; cited in Odeyinka et al., 2008) argued that this is well above the norm of 20–30% for postal questionnaires of the construction industry.

Analysis of Results

A one-way between-groups analysis of variance (ANOVA) was conducted to explore the impact of the role of professionals practising with construction clients (private and public), consultants and contractor organisations on the perception of the likelihood that a risk factor would occur. The respondents were divided into three groups (Group 1: Clients; Group 2 = Contractors; and Group 3 = Consultants). A *p* value less than 0.05 indicates that the two groups have different opinions on that particular risk factor.

Table 2. Profile of Respondents According to Sector

Sector	Number of Respondents	%	Cumulative
Contractor	34	33.0	33.0
Consultant	46	45.0	78.0
Client (private and public)	23	22.0	100.0
Total	103	100.0	

DATA ANALYSIS AND RESULTS

Data analyses were carried out using the Statistical Package for Social Sciences (SPSS Version 17.0.0).

Preliminary Analysis

Given the research methodology in the preceding section, the following subsection initially presents the preliminary analysis based on Multivariate analysis of variance (MANOVA). Field (2000) recommends conducting preliminary assumption testing for normality, linearity, univariate and multivariate outliers. Examination of indices such as Wilks' Lambda (0.506), $p = 0.000 < 0.05$ reveals that there is a statistically significant difference between the different sub-groupings (clients, contractors, and consultants) of the 25 risk factor scores. Other statistics from the MANOVA reported within this paper relate to Levene's Test and between-subject effects. The sample size (effect size) in terms of the importance of the different sub-groupings on the 25 risk factors was evaluated using the effect size statistic (Partial eta Squared), and the values ranged from 0.002 (Quality and performance control) to 0.078 (Inflation) for the 'likelihood of occurrence' and from 0.002 (Change in government policy) to 0.045 (Contract flaws) for the 'magnitude of threat risks'. This represents only 7.8 and 4.5% (respectively) of the variance, which according to Field (2000) is quite a small effect.

Table 3. Professional Background of the Respondents

Profession	Frequency	%	Cumulative
Quantity Surveyor	32	31.07	31.07
Engineer	33	32.03	63.10
Project Manager	22	21.36	84.46
Architects	11	10.68	95.14
Site Manager	5	4.86	100.00
Total	103	100.0	

Table 4. Organisation Size (Number of Employees) of Respondents

Number of employees	Frequency	%	Cumulative
Less than 25	18	17.48	17.48
25–49	17	16.50	33.98
50–99	16	15.53	49.51
100–199	15	14.56	64.07
200–300	11	10.68	74.75
More than 300	26	25.25	100.00
Total	103	100.0	

Information on the respondents' organisation and on the respondents' demographics is presented in Table 2.

Examination of Table 2 indicates that almost half (45.0%) of the respondents were practising consultants. The profile of the respondents according to their professional background is shown in Table 3.

From a professional viewpoint, the majority of the respondents were quantity surveyors (31.7%) and engineers (32.03%), with project managers (21.36%) in nearly equal numbers. Fewer of the respondents were architects (10.67%) or site managers (4.86%). The backgrounds of the respondents support the notion that they were involved with running projects at both the operational and strategic levels; therefore, they had some knowledge of issues related to the likelihood and degree of impact of risk factors on construction projects. The respondents' backgrounds further enhance the internal validity of the data (Bing et al., 2005) and suggest that they were capable of exercising sound judgement (Odeyinka et al., 2008).

The profile of the respondents according to the number of employees in their firm is shown in Table 4.

As can be observed, most (82.52%) of the respondents were in medium to large firms with more than 25 employees. The classification of organisations adopted is that used by the Ghana Statistic Service (GSS), which considers firms with less than 10 employees as small scale enterprises and those with more than 10 as medium to large enterprises. Accordingly, only 18 (17.48%) of the respondents' firms had less than 25 employees. It is evident that the majority (85) of the respondents belonged to medium and large organisations according to the value of contract work they are able to bid for (financial classes 1 and 2). The limited participation of smaller organisations in this study was warranted; in Ghana, smaller organisations do not need to implement a risk model due to the size and cost of the projects they undertake (Agyakwa-Baah, 2009).

Threat Risks for Construction Projects

A one-way between-groups analysis of variance (ANOVA) was conducted to test the hypothesis of no significant difference in the perceptions of different practising professionals [construction clients (private and public), consultants and contractors] regarding the likelihood of occurrence of risk in a construction project. The significance level of the analysis was set at a p-value of 0.05, as utilised by Cohen (1992; cited in Dulaimi et al., 2002), which is the conventional risk level. According to Dulaimi et al. (2002), the inference to be drawn from a significance level > 0.05 is that the null hypothesis of the equality of population means can be accepted and that it can be concluded that the populations have

Table 5. Contractors', Consultants' and Clients' Perceptions of the Likelihood of Occurrence of Risk Factors in Construction Projects

Rank	Risk Factor (RF)	Full Sample	Contractors (N=34)		Clients (N=23)		Consultants (N=46)		F *Stat*	Level of Sig. (p value)	Significant Difference (Yes or No)
		Overall Mean Score	MS[1]	Rank	MS	Rank	MS	Rank			
8	Financial failure	***2.51***	***2.53***	11	2.39	6	***2.54***	8	0.187	0.830	No
2	Delay in payment	***3.01***	***2.85***	3	***3.09***	1	***3.09***	3	0.921	0.402	No
12	Productivity of labour and factories	***2.34***	2.38	15	2.04	15	***2.46***	12	2.242	0.112	No
9	Availability of labour and factories	***2.49***	***2.59***	9	2.35	7	***2.48***	10	0.469	0.627	No
15	Defective materials and material shortage	2.26	***2.41***	14	2.04	14	2.26	18	1.452	0.239	No
11	Design changes	***2.45***	***2.53***	10	2.13	12	***2.54***	7	1.888	0.157	No
17	Construction method	2.20	2.38	16	1.83	19	2.26	17	***3.216***	***0.044****	***Yes***
5	Poor financial market	***2.55***	***2.65***	6	2.30	8	***2.61***	5	1.514	0.225	No
3	Inflation	***2.98***	***2.97***	2	***2.61***	4	***3.17***	1	***3.356***	***0.039****	***Yes***
1	Price fluctuation	***3.07***	***3.00***	1	***3.09***	2	***3.11***	2	0.194	0.824	No
14	Weather conditions	2.30	***2.44***	12	1.83	20	***2.44***	14	***5.301***	***0.006****	***Yes***
20	Ground conditions and contaminants	2.13	***2.44***	12	1.83	21	2.04	22	***4.528***	***0.013****	***Yes***
22	Site conditions	2.07	2.18	20	1.78	22	2.13	19	2.355	0.100	No
7	Competence of consultants and contractors	***2.54***	***2.68***	7	***2.44***	5	***2.50***	9	0.477	0.622	No
4	Quality and performance control	***2.66***	***2.71***	4	***2.61***	3	***2.65***	4	0.114	0.892	No
6	Change of government	***2.55***	***2.71***	5	2.26	9	***2.58***	6	1.372	0.259	No
10	Change of government policy	***2.47***	***2.65***	8	2.22	11	***2.47***	11	1.196	0.307	No
16	Project team relationships and communication	2.22	2.38	16	1.74	23	2.35	15	***4.414***	***0.015****	***Yes***

(Continue on next page)

Table 5. *(continued)*

Rank	Risk Factor (RF)	Full Sample	Contractors (N=34)		Clients (N=23)		Consultants (N=46)		F Stat	Level of Sig. (p value)	Significant Difference (Yes or No)
		Overall Mean Score	MS1	Rank	MS	Rank	MS	Rank			
21	Lack of commitment	2.08	2.15	22	1.91	17	2.11	20	0.665	0.517	No
13	Organisation and co-ordination	2.31	2.35	18	1.96	16	***2.46***	13	2.720	0.071	No
19	Accidents and injuries	2.15	2.18	21	2.22	10	2.08	21	0.187	0.829	No
18	Theft on site	2.22	2.24	19	2.09	13	2.28	16	0.406	0.668	No
25	Vandalism	1.51	1.47	25	1.57	25	1.52	25	0.123	0.884	No
23	Contract flaws	1.86	1.68	24	1.91	18	1.98	23	1.214	0.301	No
24	Local laws	1.75	1.71	23	1.70	24	1.80	24	0.244	0.784	No

Note: MS^1 = Mean score of the risk variable where 4 = Very High; 3 = High; 2 = Low and 1 = Very Low; a Mean scores in bold and italics denote values above the criticality point of 2.40; R = Ranking of Risk Factor; *Significant at $p < 0.05$.

rated in a similar manner (Dulaimi et al., 2002: 241) Table 5 summarises the results of the ANOVA.

Analysis of the Likelihood of Occurrence of Risk in Construction Projects

This sub-section examines the contractors', clients', and consultants' perceptions of threat risks in construction projects. Table 5 lists the likelihood of occurrence of the 25 identified construction project risk factors. Table 5 also ranks the sub-groups' (contractors', clients' and consultants') perceptions of the likelihood of occurrence of the risk factors.

As observed in Table 5, the main project risk factors ranking high in their likelihood of occurrence based on mean scores greater than the criticality cut off value of 2.40 are: (1) price fluctuation, (2) delay in payment, (3) inflation, (4) quality and performance control, (5) poor financial market, (6) change of government, (7) competence of consultants and contractors, (8) financial failure, (9) availability of labour and factories, (10) change of government policy, and (11) changes in the productivity of labour and/or the design of factories. These eleven project risks can be grouped under the five key risk drivers (four external and one internal) as illustrated in Figure 1. Financial failure and delay in payment are

Table 6. Turkey HSD Table of Post-hoc Tests on the Likelihood of Occurrence of Risk Factors among Respondents in Different Sectors of the Construction Industry

Risk Factor	(I) Which party in the construction industry do you work with?	(J) Which party in the construction industry do you work with?	Mean difference (I – J)	Std. Error	Sig.
Construction method	Contractor	Consultant	0.12148	0.18950	0.798
		Client	**0.55627***	0.22621	***0.041***
	Consultant	Contractor	–0.12148	0.18950	0.798
		Client	0.43478	0.21397	0.110
	Client	Contractor	**–0.55627***	0.22621	0.041
		Consultant	–0.43478	0.21397	0.110
Inflation	Contractor	Consultant	–0.20332	0.19331	0.546
		Client	0.36189	0.23076	0.264
	Consultant	Contractor	0.20332	0.19331	0.546
		Client	**–0.56522***	0.21828	***0.029***
	Client	Contractor	–0.36189	0.23076	0.264
		Consultant	**–0.56522***	0.21828	***0.029***
Weather conditions	Contractor	Consultant	0.00639	0.17950	0.999
		Client	**0.61509***	0.21428	***0.014***
	Consultant	Contractor	–0.00639	0.17950	0.999
		Client	**0.60870***	0.20268	0.009
	Client	Contractor	**–0.61509***	0.21428	***0.014***
		Consultant	**–0.60870***	0.20268	***0.009***

(Continue on next page)

Table 6. *(continued)*

Risk Factor	(I) Which party in the construction industry do you work with?	(J) Which party in the construction industry do you work with?	Mean difference (I – J)	Std. Error	Sig.
Ground conditions and contaminants	Contractor	Consultant	0.39770	0.18037	0.075
		Client	**0.61509***	0.21531	***0.014***
	Consultant	Contractor	–0.39770	0.18037	0.075
		Client	0.21739	0.20366	0.536
	Client	Contractor	**–0.61509***	0.21531	***0.014***
		Consultant	–0.21739	0.20366	0.536
Project team relationships and communication	Contractor	Consultant	0.03453	0.20089	0.984
		Client	**0.64322***	0.23981	0.023
	Consultant	Contractor	–0.03453	0.20089	0.984
		Client	**0.60870***	0.22684	***0.023***
	Client	Contractor	**–0.64322***	0.23981	***0.023***
		Consultant	**–0.60870***	0.22684	***0.023***

Note: *: The two groups being compared are significantly different from one another at $p < 0.05$

grouped under "financial risk" drivers; poor financial market, inflation, and price fluctuation are grouped under "economic risk" drivers; change of government and change of government policy are grouped under "government", and finally, competence of consultants and contractors and quality and performance control are grouped under "management risks". The internal key driver "resources" contains availability of labour and factories.

Examination of Table 5 further reveals that there was a statistically significant difference at the $p < 0.05$ level in the likelihood of occurrence scores for 5 out of the 25 risk factors for the three groups as follows: the technical risk factor 'construction methods' [Table 5: $p = 0.044 < 0.05$]; the economic risk factor 'inflation' [$p = 0.039 < 0.05$]; the environmental risk factors 'weather conditions' [$p = 0.006 < 0.05$] and 'ground conditions and contaminants' [$p = 0.013 < 0.05$]; and the relationship risk factor 'poor

communication amongst project team' [p = 0.015 < 0.05].

In order to ascertain where these differences were significant, post-hoc comparisons using the Turkey HSD test were conducted, and the results are shown in Table 6 only for the risk factors where there were significant differences. Lai and Lam (2010) used a similar approach to assess the perception of various performance criteria by different stakeholders in Hong Kong.

The following sub-section discusses the following five factors (see Tables 5 and 6) wherein the sub-group differences in perceptions of likelihood are significant: (1) construction method; (2) inflation; (3) weather conditions; (4) ground conditions and contaminants; and (5) project team relationships and communication.

Likelihood of occurrence of construction method risk

Examination of Table 6 shows that the mean score for contractors (mean score = 2.38, rank = 16th) was significantly different (p = 0.41 < 0.05) from that for clients (mean score = 1.83, rank = 19th) in the 'construction method' risk variable with a mean difference of –0.55627*. On the other hand, there was no significant difference between the contractors and consultants in their perceptions of the likelihood of 'construction method' risk. This seems to suggest that contractors and consultants hold consistent views on 'construction method' risk as evidenced by similar scores and rankings attributed to this risk factor. As shown in Table 6, 'construction method' risk factor was ranked 16th and 19th by the contractors and consultants respectively. There was also no significant difference between the clients and consultants in their ranking of the 'construction method' risk factor. Although these results are similar to those of Lai and Lam (2010), who also found significant differences between clients, contractors and consultants in how they perceive construction methods, they contradict those of Bresten and Marshall (2000; cited in Lai and Lam, 2010), who suggest that main contractors usually do not put much effort into promoting innovative ideas unless it is a design and build. The higher scores given by the Ghanaian contractors to the 'construction method' risk factor suggest that they consider it more important than do the clients and consultants. However, the findings related to clients are hardly surprisingly because clients would perceive 'construction method' risks as being less likely than contractors and consultants, as clients are likely to be less knowledgeable about this factor and would not be in a position to assess it reliably.

Likelihood of occurrence of inflation

There were significant differences (p = 0.29 < 0.05) between consultants and clients in their perceptions of the likelihood of the 'inflation' risk factor in a construction project. Consultants ranked this risk higher than did the clients (see Table 5), with a mean difference of –0.55627*.

However, there were no significant differences between the clients and contractors in their perceptions of the likelihood of 'inflation' risk in a construction project. This seems to suggest that contractors and consultants hold consistent views on 'inflation' as affecting construction projects.

Based on the overall sample rankings, the 'inflation' risk factor was the second most highly placed risk variable. 'Inflation' was ranked first by the consultants (mean score = 3.17) and second and fourth by the contractors (mean score = 2.97) and clients (mean score = 2.61), respectively. This finding is also consistent with literature on developing economies. The studies of Agyakwa-Baah (2007; 2009) and Frimpong et al. (2003) within the Ghanaian context and that of Denini (2009) within the Libyan construction sector identify inflation as one cause of project delays that is linked to risk analysis. This finding can be attributed to a number of challenges faced by the construction industry given the present economic crisis. The Ghanaian economy is facing challenges similar to those of many other economies due to the global recession. As of June 2009, inflation had risen to 20.74%, which is extremely high. Possible risk factors such as higher interest rates or exchange rates and additional taxes on labour, materials or the end product can seriously affect the viability of a project. Interest rates in Ghana are extremely high, which deters some foreign investors from coming into the system to invest. As observed by Frimpong et al. (2003), the inflation in Ghana is probably due to demand exceeding supply, which creates a scarcity of goods and, hence, an increase in the price of materials.

Likelihood of occurrence of weather risks

There were significant differences ($p = 0.014 < 0.05$) between contractors and clients and between consultants and clients ($p = 0.009 < 0.05$) in their perceptions of the likelihood of 'weather conditions' being a risk factor in a construction project. Contractors ranked this risk factor 12th compared to the clients, who ranked it 20th with a mean difference of 0.61509*. However, the mean difference between the consultants (rank =14th) and the clients (rank = 20th) was –0.60870*. These findings contradict those of Perera et al. (2009) who identified both employers (clients) and contractors as being responsible for the allocation of 'adverse weather conditions' risk factors. However, the findings of this study are similar to those of Kartam and Kartam (2001), in which contractors identified 'adverse weather conditions' as the second lowest significant risk out of the twenty-five risks investigated. However, despite this low ranking, that study still indicated that contractors must assume this risk. A possible explanation for the lack of importance attached by Ghanaian clients to this 'weather' risk factor is Ghana's geographical location. Ghana does not experience tornados or typhoon seasons but instead has a rainy season and high temperatures. Ghana has

two seasons, a dry and a wet season, because it is found in the tropics. As such, clients are prepared to assume this risk.

Likelihood of occurrence of ground conditions and contaminants

There were significant differences ($p = 0.014 < 0.05$) between contractors and clients in their perceptions of the likelihood of 'ground conditions and contaminants' occurring as a risk factor in a construction project. Contractors ranked this risk factor 12th, whereas clients ranked it 21st with a mean difference of 0.61509*. However, the mean difference between the consultants (rank = 14th) and clients (rank = 20th) was –0.60870*. These findings contradict those of Perera et al. (2009) who identified both employers (clients) and contractors as being responsible for allocating 'ground conditions and contaminants' risk factors. Given the rainy season in Ghana, and as opined by Tchankova (2002), the environment's influence on people and people's influence on the environment are very important aspects of this source of risk.

Likelihood of project team relationships and communication as risk factors

There were significant differences ($p = 0.023 < 0.05$) between contractors and clients and between consultants and clients ($p = 0.023 < 0.05$) in their perceptions of the likelihood of 'project team relationships and communication' serving as risk factors in a construction project. Contractors ranked this risk factor higher (rank = 12th) than did the clients (rank = 23rd) with a mean difference of 0.64322*. However, the mean difference between the consultants (rank = 15th) and clients (rank = 20th) was 0.60870*. This finding confirms the study of Kartam and Kartam (2001), which overwhelmingly assigned the contractors responsibility for this risk given that they had to co-ordinate with sub-contractors. The low ranking reported by the clients is hardly surprising given how remote they are from the actual construction process within the project's life cycle. Other studies (Lester, 2007; Tchankova, 2002) have also highlighted the importance of communication.

Ranking of the Likelihood of Occurrence of Risk in Construction Projects

The following sub-section discusses some of the five risk factors indicated by clients, consultants and contractors as most likely to occur in a construction project based on the overall mean score (see Table 5): (1) price fluctuation; (2) delay in payment; (3) inflation; (4) quality and performance control; and (5) poor financial markets. Where there were significant differences among the sub-groups in their perceptions of a risk factor, this inflation risk factor is not included within the discussion as it was covered in the preceding section; therefore, there is no discussion of the risk factor 'inflation'.

Likelihood of occurrence of price fluctuation

There was no significant difference between clients, consultants and contractors in their perceptions of or opinions on price fluctuation. However, the contractors rated this risk factor highly, followed by both clients and consultants who ranked it second. This finding is consistent with that of Kartam and Kartam (2001) who argued that 'price fluctuation' risk should reside with owners or clients. Therefore, even though the contactors ranked this first but the clients did not, an examination of the individual mean scores suggests that the clients (mean score = 3.11) scored this factor slightly higher than the contractors (mean score = 3.09).

Likelihood of occurrence of a delay in payment

All three of the parties (clients, consultants and contractors) ranked delay in payment first. This finding is consistent with the literature in developing countries (Addo-Abedi, 1999; Frimpong et al., 2003; Agyakwa-Baah, 2007; 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 from the government stifle progress on projects. Other studies within the South African context aimed at risk identification, quantification and classification (Othman and Harinarain, 2009; Harinarain and Othman, 2007) and the study of Harinarain et al. (2008) have identified clients and quantity surveyors as a source of risk to contractors when dealing with final accounting and final payments.

Although prudent contractors adopt remedial strategies to protect themselves, such as delaying payments to sub-contractors, submitting inflated claims for extra work, threatening legal action for breach of contract, and blacklisting poorly performing clients, the study by Agyakwa-Baah (2009) shows that most construction professionals try to avoid courtrooms for fear of compromising future opportunities. One of the contributing factors is the reliance on standard contracts, as Ghanaians are generally conservative. It is therefore suggested as a risk handling strategy that project stakeholders move towards bespoke contracts, which might introduce contract flaws. This would enable contractors to allocate the risk to clients by ensuring that interest is paid on delayed payments.

From a corporate social responsibility point of view, the general public in Ghana should also be encouraged to hold the government accountable for monies used on Government projects that are delayed and that exceed the budget. Frimpong et al. (2003) identified bureaucracy in Ghanaian government departments as a contributing factor coupled with the nature of the funding of projects, which can either be through domestic savings or foreign funding. Similar studies such as those of Adams (2004) and of Agyakwa-Baah (2007) have revealed that payment delays are the most important

factor underlying project delays. Unfortunately for most construction firms, the Government is the main client of the industry, and avoiding their projects means fighting for the few projects brought in through the private sector. There is so much bureaucracy in the Government agencies that it takes too long for certificates to be issued for payments. In addition, Addo-Abedi (1999; cited in Tuuli et al., 2007) observed that there is no form of compensation for contractors.

Likelihood of quality and performance control as risk factors

The fourth most highly ranked risk variable was that of 'quality and performance'. This was ranked third (mean score = 2.61) by the clients and fourth by both the contractors (mean score = 2.71) and consultants (mean score = 2.65). Despite the disparity in the ranking between the sub-groups, it is evident and consistent with previous studies that contractors have to assign this risk to themselves because only they can handle this task of quality and performance control (Kartam and Kartam, 2001). The almost identical scores assigned to this risk factor by all three sub-groups suggest that all the stakeholders have consistent views on the importance of quality and performance control. This finding is consistent with that of Lai and Lam (2010).

Likelihood of poor financial markets as a risk factor

The fifth most highly ranked risk variable was that of 'poor financial markets'. Despite a higher ranking (5th) by the consultants than the contractors (6th), the contractors had a slightly higher mean score (2.65) than did the consultants (mean score = 2.61). The clients ranked this risk factor 8th and recorded a lower score (mean score = 2.30). However, despite this disparity in the ranking of the 'poor financial markets' risk factor, the implications to be drawn are that clients, contractors and consultants hold consistent views on the likelihood of 'poor financial markets' occurring as a risk factor in a construction project as evidenced by the lack of significant differences.

Other variables

Other variables that were considered to have the lowest impact were 'contract flaws' (overall mean score = 1.86, rank = 23rd), 'local laws' (overall mean score = 1.75, rank = 24th), and 'vandalism' (overall mean score = 1.89, rank = 25th). Agyakwa-Baah (2009) observed that in Ghana, bespoke contracts are not widely used and because standard contracts are used, contract flaws are not very prevalent. This is an interesting development considering that, within this study, the majority of the client respondents were government institutions. Regarding 'vandalism', it is also very destructive, but it does not generally occur on sites in Ghana, as indicated by Agyakwa-Baah (2009).

Magnitude of the impact of risks on construction projects

A one-way between-groups analysis of variance was conducted to explore the roles of practising professional organisations [construction clients (private and public), consultants and contractors] on the perception of the magnitude of risk factors. The respondents were divided into three groups as follows: (1: clients, 2: contractors, 3: consultants). Table 7 summarises the results of the ANOVA. There was a statistically significant difference at the $p < 0.05$ level in the severity of risk impact scores for only 1 of the 25 risk factors for the three groups: the economic risk factor 'price fluctuation' [Table 7: $p = 0.006 < 0.05$].

The following sub-section discusses this one factor (see Table 7) where there were sub-group differences in perceptions of the magnitude of risk, namely (1) price fluctuation.

Magnitude of the impact of price fluctuation risk

There were significant differences ($p = 0.020 < 0.05$) between contractors and consultants and between consultants and clients ($p = 0.010 < 0.05$) regarding the magnitude of the 'price fluctuation' risk. Contractors ranked this risk factor 7th, whereas the consultants ranked it 3rd with a mean difference of –0.5020*. Moreover, the mean difference between the consultants (rank = 3rd) and clients (rank = 10th) was –0.6145*. This finding contradicts that of Kartam and Kartam (2001), who argued that 'price fluctuation' risk should reside with owners or clients; therefore, it was expected that clients would rank this risk factor higher than either consultants or contractors.

Considering that 'price fluctuation' was the only variable out of 25 on which the contractors, clients and consultants failed to agree, the null hypothesis cannot be rejected. Odeyinka et al. (2008) used the same approach, and they accepted the null hypothesis when only 1 variable out of 26 was significant. The risk factor 'price fluctuation' was ranked fourth based on the overall score (see Table 7) for the magnitude of this risk for construction projects. 'Price fluctuation' was ranked third by consultants (mean score = 3.24), whereas the contractors and clients ranked it seventh (mean score = 2.77) and tenth (mean score = 2.65), respectively.

The price fluctuation risk variable is closely aligned with the inflation variable within the economic risk factor category. As observed by Frimpong et al. (2003) and Agyakwa-Baah (2009), the present economic crisis contributes to price fluctuation. Accordingly, this has caused local firms to gradually die out because foreign firms (contractors) carry out almost all the projects, leaving few for local firms. This finding is supported by the observation of Assibey-Mensah (2008) that over the years, the country's indigenous construction firms have had to compete (unsuccessfully) for construction contracts with large, well-equipped, and well-managed

Table 7. Contractors', Consultants' and Clients' Perceptions of the Magnitude of Risk for Construction Projects

Rank	Risk Factor (RF)	Full Sample	Contractors (N=34)		Clients (N=23)		Consultants (N=46)		F *Stat*	Level of sig. (p value)	Significant Difference (Yes or No)
		Overall Mean Score	MS (*)	Rank	MS (*)	Rank	MS	Rank			
3	Financial failure	***2.99***	***2.77***	***8***	***2.96***	**3**	***3.17***	**4**	1.693	0.189	No
1	Delay in payment	***3.15***	***3.06***	***1***	***3.00***	**1**	***3.28***	**1**	1.041	0.357	No
13	Productivity of labour and factories	***2.65***	***2.82***	***4***	2.39	**16**	***2.65***	**13**	1.547	0.218	No
10	Availability of labour and factories	***2.69***	***2.82***	***5***	***2.44***	**15**	***2.72***	**11**	1.216	0.301	No
11	Defective materials and material shortages	***2.69***	***2.71***	***11***	***2.78***	**5**	***2.63***	**14**	0.197	0.822	No
14	Design changes	***2.60***	***2.65***	***13***	***2.52***	**14**	***2.61***	**15**	0.136	0.873	No
16	Construction method	***2.50***	***2.74***	***9***	2.22	**23**	***2.46***	**16**	2.213	0.115	No
12	Poor financial markets	***2.68***	***2.59***	***15***	***2.70***	**8**	***2.74***	**8**	0.283	0.754	No
2	Inflation	***3.04***	***2.79***	***6***	***2.96***	**2**	***3.26***	**2**	2.740	0.069	No
4	Price fluctuations	***2.95***	***2.77***	***7***	***2.65***	**10**	***3.24***	**3**	***5.367***	***0.006****	***Yes***
20	Weather conditions	2.28	2.29	***19***	2.26	**19**	2.28	**20**	.011	0.989	No
19	Ground conditions and contaminants	2.28	2.21	***20***	2.26	**21**	2.35	**19**	.259	0.772	No
18	Site conditions	2.34	2.33	***18***	2.35	**18**	2.37	**17**	.028	0.972	No
7	Competence of consultants and contractors	***2.79***	***2.62***	***14***	***2.74***	**7**	***2.94***	**6**	1.003	0.370	No
5	Quality and performance control	***2.92***	***2.71***	***10***	***2.96***	**4**	***3.07***	**5**	1.710	0.186	No
6	Change of Government	***2.84***	***2.88***	***2***	***2.74***	**6**	***2.87***	**7**	0.145	0.865	No
8	Change of Government Policy	***2.75***	***2.82***	***3***	***2.70***	**9**	***2.73***	**10**	0.124	0.884	No
15	Project team relationships and communication	***2.59***	***2.47***	***17***	***2.61***	**13**	***2.67***	**12**	0.371	0.691	No
17	Lack of commitment	***2.46***	***2.50***	***16***	***2.61***	**12**	2.35	**18**	0.546	0.581	No

(Continue on next page)

Table 7. *(continued)*

Rank	Risk Factor (RF)	Full Sample	Contractors (N=34)		Clients (N=23)		Consultants (N=46)		*F Stat*	Level of sig. (p value)	Significant Difference (Yes or No)
		Overall Mean Score	MS (*)	Rank	MS (*)	Rank	MS	Rank			
9	Organisation and co-ordination	***2.69***	***2.68***	***12***	***2.61***	**11**	***2.74***	**9**	0.153	0.858	No
22	Accidents and injuries	2.12	2.03	***22***	2.39	**17**	2.04	**24**	1.239	0.294	No
21	Theft on site	2.20	2.12	***21***	2.26	**20**	2.24	**22**	0.239	0.788	No
25	Vandalism	1.89	1.71	***25***	2.04	**24**	1.96	**25**	1.169	0.315	No
23	Contract flaws	2.12	1.82	***24***	2.26	**22**	2.26	**21**	2.130	0.124	No
24	Local laws	2.00	1.91	***23***	2.00	**25**	2.07	**23**	0.269	0.765	No

Note: MS[1] = Mean score of the risk variable where 4 = Very High; 3 = High; 2 = Low and 1 = Very Low; a Mean scores in bold and italics denote values above the criticality point of 2.40; R = Ranking of Risk Factor; *Significant at $p < 0.05$.

foreign construction businesses. Ofori (1994) also identified that highly advanced forms of construction technology have mostly been used in Ghana by foreign contractors, whereas local contractors have found it difficult to acquire plants and equipment. On the other hand, the findings contradict those of Kartam and Kartam (2001) from the clients' ranking point of view. As explained earlier in the 'inflation' sub-section, from a risk-allocation point of view, Godfrey (1996; cited in Perera et al., 2009) argues that clients should adopt this risk, including taking responsibility for controlling this risk. As such, the client sub-group should have ranked it higher than either the contractors or consultants.

Ranking of Construction Project Risks by Magnitude of Impact

The following sub-section discusses four out of the five most important risk factors agreed on by clients, consultants and contractors as having a high magnitude of impact on construction projects based on overall mean score (see Table 7): (1) delay in payment; (2) inflation; (3) financial failure; (4) price fluctuations, and (5) quality and performance control. Where there were significant differences among the sub-groups in their perception of a risk factor, this factor was not included in the discussion because it was covered in the preceding section; therefore, there is no discussion of the risk factor 'price fluctuation'.

Magnitude of the impact of a delay in payment

All three of the parties (clients, consultants and contractors) ranked delay in payment first. This finding is consistent with the literature in developing countries (Addo-Abedi, 1999; Frimpong et al., 2003; Agyakwa-Baah, 2007; Adams, 2008). As observed by Rameezdeen and Ramachandra (2008), a study of factors that cause delays (Agyakwa-Baah, 2007) revealed that delayed payment is the most important factor underlying project delays. Unfortunately for most construction firms, the Government is the main client in 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 too long for certificates to be issued for payments.

Magnitude of the impact of inflation

The second most important risk variable identified based on the overall mean score was that of inflation. Of the three parties, only the clients and consultants rated this risk highly, whereas the contractors ranked it sixth. This finding is hardly surprising as Kartam and Kartam's (2001) study of the Kuwaiti construction industry suggested that this risk is dependent on the economic conditions of the country. Moreover, this risk is allocated to the employer, which in this case is the government. Given the high inflation rate of Ghana as previously described, it is hardly surprising that clients ranked it higher. However, it is notable that the consultants attached equal importance to this risk. The findings also suggest and confirm that inflation is only regarded as a risk by contractors if they are bound to a fixed contract.

Magnitude of the impact of financial failure

The third risk factor identified was that of financial failure. This was ranked third and fourth by clients and consultants, respectively, whereas contractors ranked it eighth. Financial risks have an important impact on firms and on the economy as a whole. When there is a freeze on capital, a delay in payment, bankruptcy of stakeholders or financial failure, this creates a difficult situation for firms carrying out projects. This finding is also consistent with the literature on developing economies. For example, the study by Agyakwa-Baah (2009) in Ghana revealed that a number of firms wish they could avoid bidding for Government-funded projects because the Government, as the main client in the industry, is the main culprit in delaying payments. This study also confirms the findings of Dada and Jagboro (2007) who identified financial failure as one of the main factors contributing to cost overruns in Nigerian construction projects. Earlier studies, such as that of Akintoye and MacLeod (1997), also acknowledged financial risk as having the most adverse consequences on the successful completion of construction projects. On the other hand, when considering the rankings of the contractors in isolation, the results contradict those of Odeyinka et al. (2008) who found client insolvency to

be the least important. These results also provide some insights into the Ghanaian contractors' understanding of the risk of financial failure. Given that no distinction was provided between 'contractor failure' and 'client failure' within the catalogue of risks, as in previous studies classifying financial failure, the lower ranking (8th) of this risk by contractors compared with either clients or consultants suggests the contractor sub-group could have made incorrect assumptions. Kartam and Kartam (2001) suggest that this risk is linked to economic conditions, and the importance attached by contractors to it would be dependent on the economic climate at the given time. Thus, during recessionary periods, contractors would be expected to desire a risk-sharing approach.

Magnitude of the impact of quality and performance

Quality and performance control was ranked fifth based on the overall sample score; it was ranked fourth and fifth by clients and consultants, respectively, whereas contractors ranked it tenth. This finding is very notable given that contractors have a major influence on the end product during the construction process. However, as observed by Agyakwa-Baah (2009), specifications from clients are not always adequate, and contractors seek to make profit by compromising and using low-quality materials. Corruption is another contributor to the lack of control over quality and performance (Agyakwa-Baah, 2009). One of the mitigating measures for this risk is the adoption of effective quality control procedures.

STUDY LIMITATIONS

The findings of this study cannot be generalised statistically to all of Ghana because it is geographically constrained, with respondents only drawn from a purposive sampling of construction organisations in the Greater Accra Region. Furthermore, the study did not distinguish between local and foreign contractors. As Adams (2008) demonstrated, perceptions of risks between the two groups tend to vary. Nevertheless, as asserted by Chileshe (2004), the findings represent a snapshot of the perceptions of construction professionals regarding the likelihood and the degree of impact of the identified risks on construction projects. The second limitation pertains to the usage of survey data based on self-reported opinions of professionals within organisations. Such data may not provide reliable estimates of the likelihood of occurrence and severity of impact of risks. However, there is consistency between the quantitative and qualitative parts (such as the literature review) of this study. Moreover, the results do appear to be consistent with previous research examining the likelihood of occurrence and severity of impact of risk factors on construction projects.

CONCLUSIONS

This paper has presented the perceptions of contractors, clients and consultants within medium and large Ghanaian construction-related organisations regarding the likelihood of occurrence and severity of impact of construction project risk factors. The risk factors identified from an extensive literature review have been analysed using analysis of variance in order to identify differences in perception among the respondent sub-groups (contractors, clients and consultants), and descriptive statistics such as mean scores and standard deviations were used to rank the factors.

It can also be concluded that the ranking and importance of different factors vary between developed and developing economies. For example, a study by Odeyinka et al. (2008) limited to contractors in the UK ranked 'changes to initial design' first in both frequency and severity of impact, whereas 'delay in payment from the client' is the major risk factor in developing economies. The different risk variable rankings between developing countries (as identified in this study) and developed countries (e.g., Odeyinka et al., 2008) illustrates how the country context sheds new theoretical light on the interpretation and importance of risk variables.

Analysis of the results revealed that there was complete agreement among the three samples (clients, contractors and consultants) regarding the ranking of the financial risk factor 'delay in payment'. There was also complete agreement between the clients and consultants on the ranking of the economic risk factor 'inflation'. Nevertheless, some differences in the perception of risk occurrence were found to exist in relation to 'construction methods', 'inflation', 'weather conditions', 'ground conditions and contaminant conditions', and 'poor communication amongst project team'. Whereas the clients and contractors did not regard some of these risk factors as crucial, the contractors ranked 'construction methods', 'weather conditions' and 'ground conditions and contaminant conditions' moderately higher than did the clients and consultants. In contrast, poor communication amongst project team' and 'inflation' were ranked higher by 'consultants'. Several implications emerge that affect the implementation of mitigation measures targeting the consequences of the risks affecting construction projects in the Ghanaian construction industry. Three can be singled out as having major implications.

Economic implications

The issue of economic risk factors is of paramount importance given that the construction industry is facing a number of challenges that the present economic crisis has exacerbated. Moreover, price fluctuations and high

inflation have contributed to considerable instability in the industry. It can also be argued that financial risks are vital to organisations and the economy as a whole. Freezes on capital, delays in payment, bankruptcy of stakeholders or financial failure all create difficult situations for firms carrying out projects. This situation calls for movement towards bespoke contracts, which might introduce contract flaws, as opposed to the over-reliance on standard contracts. This change would not only enable contractors to allocate risk to the client by ensuring that interest is paid on delayed payments, but it could also incorporate better payment terms.

Government implications

The political risk factor was ranked fourth by the three groups in terms of the severity of impact. Change of government and change in government policy are ever-present risk factors in view of the frequency of elections (every four years in Ghana). Therefore, the inference to be drawn is that during that period (election years), most government projects and pending payments are put on hold until the next ruling party comes into office. This situation creates problems for the industry because monies are locked up and, therefore, organisations are not able to take on other private jobs.

Relationship implications

In terms of the relationship risk factor, it is worth noting that effective communication is vital to project success and must be established early in the project. Another risk factor is that of resources. In Ghana, finding labour for a project is not a problem, but factories and equipment are a major problem for most construction firms, especially local firms. One major challenge mentioned by professionals who work for local firms was that local construction organisations are gradually dying out because foreign firms carry out almost all the projects, leaving very few projects for local firms.

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