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DEPARTMENT OF BUILDING TECHNOLOGY

A CONCEPTUAL PRE-BID RISK ANALYSIS MODEL FOR GHANAIAN CONSTRUCTION FIRMS

BY

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DECLARATION

I declare that I have fully undertaken the research reported herein under supervision.

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I declare that I have supervised the student in undertaking the research reported herein and I confirm that the student has effected all suggested changes by examiner

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2008

ROBERT ALEX SACKEY

DEDICATION

To my wife - Mrs.Ewuraba Walker Sackey and our children - Oye, Sekyiwa and Ahomka

And to my mother – Mrs Flora Sackey, my mentor, and unrelenting supporter through everything

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ABSTRACT

Construction companies in Ghana generally procure jobs through competitive bidding or through direct negotiations with client representatives, with competitive bidding being the more prevalent of the two. Due to constraints of time and other resources, construction companies cannot afford to bid for every project that comes their way.

The decision to bid or not to bid for a project is one of the contractor's greatest dilemmas. Each construction firm must seek to optimize or balance the workload in order to maximize profitability. However, bidding on the 'wrong' projects can have costly ramifications, whereas not bidding on the 'right' projects can lead to substantial opportunity cost.

Due to the uncertainty of bidding outcomes, a certain level of risk is faced by the contractor with each bid, hence the need for some form of risk analysis at the bidding decision stage. Such analyses could help inform the contractor about his chances of winning the bid, successfully executing the successful bid' and the project's potential profitability.

A determination of the 'risk profile' of a project could influence a contractor's decision to bid or not to bid, and even what level of mark-ups to assign to the bid in terms of normal risk/return relations. Unfortunately, due to the complex and time-consuming nature of existing project risk analysis and management models/systems, most of our local contractors have little knowledge of, and use for, formal risk analysis.

The main aim of this research was to develop a simple, quantitative risk model for profiling prospective construction projects in order to enable construction firms form fairly accurate risk perceptions for respective construction projects. This would aid them in their decision to bid or

not to bid, and also with determining mark-up policies and prioritizations for respective proposed projects.

The proposed model was based on developing a simple quantitative model from an existing qualitative project risk profile framework previously presented at the Herriott Watt University (see Appendix A). The goals of the modification process were to:

1. Establish the local (Ghanaian) relevance of each of the seventeen (17) risk factors proposed in the original model.
2. Prioritize and reduce the number of risk factors utilized, to a total less than ten (10) for incorporation into the proposed model, in a bid to make it simpler, user-friendly, and less time-consuming for potential users.
3. To develop and assign relative weightings to the each respective risk factor chosen by survey, which when in simple multiplied by their respective risk ratings can be summed up to give an overall risk profile score for each respective proposed project.

The research comprised a questionnaire survey, backed with interviews of contractors, consultants, project managers, etc, in Accra and Kumasi, all of whom had had some appreciable experience influencing bid decisions.

The research revealed that respondents considered each of the seventeen (17) factors to be of some relevance to the risk profile of a project, even though some were regarded as of relatively less relevance than others. A few additional factors, such as ‘political influence’, were also suggested by a significant number of respondents. Furthermore, the vast majority of respondents were convinced that some formal risk analysis was required in making bidding decisions. They also agreed that the proposed risk profile model would be a useful tool to aid bidding decisions by local construction organizations.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

Construction firms in Ghana generally procure jobs in two (2) ways: either by bidding through direct negotiation with clients, or through some form of competitive bidding (Amoah, 1999). Competitive bidding is the most prevalent option used, since the competition tends to result in lower bid prices.

Even though construction companies, like other businesses, seek to maximize turnover, for profit purposes, contractors generally cannot, and do not, bid for every job that comes their way. Rather, they usually select from a continually changing array of potential projects. ((Odusote, 1992) : (Hohoabu, 1999)).The number of bids a contractor can make is limited by the costs of bidding and the time involved, as well as personnel and other resources.

1.2 STATEMENT OF THE PROBLEM

The bid/no-bid decision for a construction company is a key strategic decision that may have profound effects on its long and short term performance objectives. (Hohoabu, 1999). The decision to bid or not to bid for a project is often times one of the greatest dilemmas a contractor must face following an enquiry to bid. Often times the temptation is to bid on most projects that become available in order to keep work ongoing and avoid idle production. Yet the decision to bid on a construction project which is not suitable for a particular company can have costly ramifications, not only financially, but could just as well damage the future credibility of the company. Very often, passing up on the opportunity to bid on a project may be the best decision a builder can make.On the other hand, the decision not to bid for a particular project could incur an opportunity cost that is often hard to estimate.

The decision to bid may lead to either winning the project and executing it for a profit, or loss, or on the other hand losing the bid to some other competitor. In the latter case, the contractor loses his investment in the bidding process.

The uncertainty about the outcome of the bidding decision introduces a certain level of risk to the company in the process.Kwakye, a leading member of the Ghana Institute of Surveyors wrote that most commercial decisions in construction (including bidding decisions) are made under conditions of risk and uncertainty (Kwakye, 2005).He states that, in construction, risk often lies hidden at both the pre-tender and production phases of projects. Risks encountered on a construction project may lead to one or more of the following:

a) Failure to keep within cost
b) Failure to keep within stipulated time for construction
c) Failure to meet the required technical standards for quality, function, fitness for purpose , safety and environmental preservation (Asare, 2004)

Clearly, from the foregoing discussions, the project risk analysisprocess is vital to the construction firm that intends to succeed and remain in business and needs to be started right from the time of the bidding decision. This is important because contractors must first determine what risks are associated with each project, and make a choice of whether to bid on the project, and manage its associated risks, or to reject the project altogether. This study will concern itself with risk analysis during the bid/ no bid decision stage.

Business firms, globally, are becoming more aware of the role of risk management in ensuring project success, and hence it is not surprising that lately more attention is being paid to the subject. In recent years, a wide range of project risk analysis and management (PRAM) techniques have been developed and are used extensively in other industries such as the banking, finance and investment sectors. Some of these techniques involve the use of mathematical formulas and computer software in quantitative risk analysis (e.g. AHP, Decision Tree, Influence Diagrams, Monte Carlo Simulation), as well as simpler models in qualitative risk analysis(Anderson, J and Williams 2003).

The situation in the construction industry, however, has been different. Flanagan and Norman wrote that most risk identification and appraisal carried out on the property and construction industry is poor,compared to money market. (Flanagan & Norman, 1993). They also pointed out that poor quality risk management in construction has gained significance as clients are demanding more, and everybody is becoming more conscious of the risk they are carrying." (Flanagan & Norman, 1993). They further observed that in the construction industry, the euphoria, optimism and excitement of a new project leads to the AGAP (All Goes According To Plan) attitude. Stakeholders tend to give budgets, estimates, and completion dates based on the 'All Going According To Plan'. However construction has many unknowns, and things rarely go according to plan, and there is therefore the need to be more aware of WHIF (What happens if) analysis. (Flanagan & Norman,1993). There is therefore the need for construction stakeholders to adopt good quality risk management practices to ensure that client and project objectives are satisfactorily met.

However, in our local construction industry, most local contractors have little knowledge of, and use for, formal risk management.(Asare, 2004). Like the industry worldwide, most risk analysis and management depend mainly on judgement, intuition and experience. Formal risk analysis and management techniques are rarely used due to the lack of knowledge and doubts on the suitability of these techniques for construction activities.” (MacLeod, 1996)

Some major reasons for the low patronage of PRAM systems by construction organizations may include: process costs, time required, and the resource availability. “The cost of using the process can be as little as the cost of one or two days of a person’s time, up to a maximum of 5 – 10% of the management costs of the project…” (APM, 2000) “The time taken to carry out a risk analysis is partially dependent upon the availability of information. A detailed cost and time risk analysis usually requires anywhere from one (1) to three (3) months depending upon the scale and complexity of the project. However, in some cases a useful analysis can take as little as one (1) or two (2) days” (APM, 2000).

It is therefore apparent that the time and cost implications of using most of these formal risk analysis techniques serves as a disincentive for most of our local construction firms from pursuing these alternatives. Particularly at the bidding stage, where there is usually little time between the invitation to bid and the bid submission deadline, the contractor cannot often afford the luxury of going through a lengthy process of risk analysis before deciding to bid for a project.

On the other hand, however, construction firms are business entities with vested interests in every project they undertake, so it is important for them to understand the potential risks associated with every proposed project that they contemplate bidding for. Such understanding of project risks can aid the contracting organization in its bid/ no bid decision, as they can foresee and avoid bidding for overly risky projects, or choose to bid whilst making provisions for risk mitigation. It can also help the contractor better assess the most suitable kind of contract needed , as well as the adequacies of the contingencies thus provided.

Clearly, local construction organizations need to be encouraged to adopt the practice of formal PRAM. For this to happen, it would require customized PRAM tools and techniques which efficiently address the peculiar needs of the industry. These tools and techniquesmust be simple, user friendly, provide quick and reliable results, must be trustworthy, authentic, adaptable, and must incorporate construction expertise and opinion.

Based on the above discussions, this study seeks to develop a simple but effective, user-friendly, risk modelthat will guide the local contractor's risk perception of projects at the bidding decision stage to help facilitate his/ her decision to bid. The proposed model will provide the contractor with a quick but accurate risk perception of proposed projects until such time as a more detailed risk analysis can be done.

1.3 KEY QUESTIONS

a) What is the Ghanaian construction industry's general perception of risk associated with its activities and the extent to which the industry uses risk analysis and management techniques.

b) i) What factors that determine the risk perceptions of projects by construction firms in Ghana?

   ii) Are the factors proposed in the Heriot-Watt framework relevant in the Ghanaian experience?

c) What factors influence the attitude and approach of the construction industry towards conventional project risk analysis techniques?

1.4 AIM OF RESEARCH

The purpose of this study is to develop and proposea simple quantitative riskmodel that can be used byGhanaian construction organizations to formrisk perceptions oflocal constructionprojects, in order to inform their bid/ no bid decision process.

1.5 OBJECTIVES OF RESEARCH

The main objectives of this proposed research were:

a) To review existing literature to establish an understanding of how project risk analysis techniques can be used to inform contractors' bid/ no bid decisions in the Ghanaian construction industry.
b) To survey expert opinion on what project characteristics influence contracting firms' risk perception of construction projects, at the pre-bid stage, using the Heriot-Watt project risk profile framework (See Appendix A), as a starting point.
c) To assign relative weightings to the respective project characteristics/factors which reflect the measure of how they contribute to contractors' risk perception of projects
d) To develop the above into a project risk analysis (perception) conceptual model that employs a simple quantitative approach leading to a simple quantitative analysis.

1.6ORGANISATION OF THE STUDY

- Chapter One introduces the existing problem in the global and local industry, aims, objectives, scope and importance of study
- Chapter Two presents a detailed literature review of the subject matter, and includes key definitions, as well as discussions of relevant subject areas bordering on the role of risk management practices in construction; with particular emphasis on bid/nobid decision making stages.
- Chapter Three presents the general study procedure and outlines details of the questionnaire survey together with the methods employed to analyse the data.
- Chapter four presents the results of the questionnaire survey on the factors identified by the selected contractors as influencing project risk perception.
- Chapter five presents the proposed conceptual model
- Chapter six presents the conclusions and recommendations of this study.

Finally, three appendices containing details of the questionnaire format used for the survey, information on the proposed model, as well as a bibliography of the books and journal articles consulted during the study are presented at the end.

CHAPTER TWO

LITERATURE REVIEW

2.1 FACTORS AFFECTING PROJECT RISK PERCEPTION IN CONSTRUCTION FIRMS

The study will now proceed to review some contemporary definitions of the key terms employed in the field of risk analysis and management.

2.1.1Risk and Uncertainty

"Risk is a major factor to be considered on the management of any project. It can be defined as uncertainty of outcome (whether positive opportunity or negative threats)." (Office of Government Commerce, UK 2005). The Australian /New Zealand standard (AS/NZ 4360 1999) defines risk as, "the chance of something happening that will have an impact on (project) objectives." The ((BSI Guide 73 2002)) further defines risk as, "the combination of the possibility of an event and its consequence." This BSI view is purely concerned with the possibility of a cause (the event) and the related effect (the consequence. It makes no reference to loss, damage or any other notion of a negative outcome of risk. ((University, Heriot-Watt 2004)) "Project risk is primarily the likelihood of negative occurrences adversely affecting the project so that its objectives become more difficult or even impossible to achieve" - ((BS6079-1 2002)). The foregoing definition is more in line with the common perception of risk as being overwhelmingly negative and something to be avoided. However, the qualifier 'primarily' hints that there are consequences and effects of risk other than negative ones which is consistent with the strictly correct definitions of risk.(University, Heriot-Watt 2004).

Two of the main international professional bodies governing project management, namely the Project Management Institute (PMI), and the Association of Project Management (APM), have developed their own view of risk.

The PMI's Project Management Body of Knowledge (Project Management Institute 2000)defines risk as "an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives." This view is more explicit about the possibilities of positive or welcome effects of risk i.e. situations or events turning out better than planned or expected. Since this definition relates to a project, the effects of risk relate to the effects on the project's time , cost, and quality objectives, either for the project as a whole or some sub-part of the project e.g. a particular work package or trade operation etc. A negative impact will obviously mean late completion, cost over-runs, or not meeting the required level of quality, either individually or more seriously in combination.

The APM defines risk as "an uncertain event or set of circumstances that should it occur, will have an effect on the achievement of project objectives."(APM 2000). This view is very similar to that of the PMI, although in addition to risk being associated with a specific cause (event) or condition- a ' set of circumstances' can pose a risk to project outcomes. This is appropriate to construction projects, particularly large and complex ones where there may be many interdependent parties and activities contributing to the project. In such cases the precise cause (event) of a cost or schedule overrun can be far from clear and responsibilities not easily apportioned. Rather, it has to be untangled from the 'set of circumstances' surrounding the project.(University, Heriot-Watt 2004) .

Although project management literature recognizes that risk stems from uncertainty which can lead to better outcomes than expected, the more conventional view is that risk is something to be avoided or minimized where possible, certainly when discussed in the context of construction projects. Where there is a possibility that things may turn out better as well as worse than planned, risk is usually referred to with negative connotations i.e. downside risk events which are associated with the concept of loss only.

The terms risk and uncertainty are often used together and sometimes considered to be interchangeable and synonymous. The concepts are very close and, for the purposes of construction risk management, some writers tend not to differentiate between them. However there is a distinction to be made between the two concepts. Recent research on project risk management has highlighted a clear difference between discrete risk events and a more amorphous uncertainty.(University, Heriot-Watt 2004)

Chapman(Chris and Stephen 2007) described uncertainty on a project as including one or more of the following:

- Lack of clear specification of what is required
- Novelty, lack of experience of a particular project or activity
- Complexity in terms of the number of influencing factors and inter-dependencies between these factors
- Limited analysis of the processes involved in the activity
- Possible occurrence of particular events or conditions which could have some uncertain effect on the activity. They also identify four categories where uncertainty exists in the project, namely:

- Uncertainty about the basis of estimates. Both client and contractor make estimates and forecasts relating to budgets, tendering, scheduling, and programming. These include both objective and subjective judgements. Hence the level of uncertainty will depend on the estimators' ability, experience and available resources.
- Uncertainty about design and logistics. At the earlier conceptual and briefing stages of the project life cycle, the technical design and related construction process for the building or facility are fundamental uncertainties. The uncertainty reduces as the design progresses and these issues are resolved.
- Uncertainty about objectives and priorities. Lack of clarity, mutual understanding, and agreement on project objectives and their relative priorities, within the project team can lead to an uncertainty. Project objectives should reflect and reconcile the requirements of all project stakeholders.
- Uncertainty about the project organization. The multiplicity of people, business units and organizations involved in a project and the fundamental relationships that exist between these parties are often a cause of uncertainty. The interrelationships are often complex and may not involve formal contracts. Conditions of uncertainty arise from ambiguity in respect of: specification of responsibilities; perception of roles and responsibilities, communication between parties; contractual conditions; mechanisms for coordination and control.

2.1.2 Risk and Risk Attitude

It is important to appreciate the attitude to risk of clients and contracting organizations. Interpretation of the seriousness of risks and their response is mostly subjective. Different people, given the same information on risk exposure for a situation will likely respond differently depending on their attitude and whether they are risk seeking, risk averse, or risk neutral. What is an acceptable risk to one may not be acceptable to another.

It is therefore a combination of risk exposure and attitude that will dictate responses to and strategies for dealing with risk. While risk exposure, the extent of maximum possible loss, can be quantified fairly easily, risk attitude cannot. (University, Heriot-Watt 2004)

2.1.3Project Risk Analysis and Management

Project risk analysis and management is a process which enables the analysis and management of risks associated with a project. Properly undertaken, it will increase the likelihood of successful completion of a project to cost, time, and performance objectives.

Risks for which there is ample data can be assessed statistically. However, no two (2) projects are the same. Often things go wrong for reasons unique to a particular project, industry or working environment. Dealing with risks in projects is therefore different from situations where there is sufficient data to adopt an actuarial approach. Because projects invariably involve a strong technical, engineering, innovative or strategic content a systematic process has proven preferable to an intuitive approach. Project Risk Analysis and Management (PRAM) is designed to meet this requirement.(APM 2000)

PRAM is a process designed to remove or reduce risks which threaten the achievement of project objectives. Experienced risk analysts and managers hold perceptions of this process which are subtle and diverse. The process may however be divided into two stages:

- Risk Analysis
- Risk Management

2.1.3.1 Risk Analysis

This stage of the process is generally split into ‘ sub-stages’; a qualitative analysis ‘sub-stage’ that focuses on identification and subjective assessment of risks and a quantitative analysis ‘sub-stage’ that focuses on an objective assessment of the risks.

A qualitative analysis allows the main risk sources or factors to be identified. This can be done, for example, with the aid of checklists, interviews or brainstorming sessions. This is usually associated with some form of assessment which could be the description of each risk and its impacts or a subjective labeling of each risk (e.g. high/ low) in terms of both its impact and its probability of occurrence. A sound aim is to identify the key risks, perhaps between five and ten, for each project (or part-project on large projects) which are then analyzed and managed in more detail.

A quantitative analysis often involves more sophisticated techniques, usually requiring computer software. To some people this is the most formal aspect of the whole process requiring:

- Measurement of uncertainty in cost and time estimates
- Probabilistic combination of individual uncertainties.

Such techniques can be applied with varying levels of effort ranging from modest to extensively thorough.

An initial qualitative analysis is essential. It brings considerable benefit in terms of understanding the project and its problems irrespective of whether or not a quantitative analysis is carried out. It may also serve to highlight possibilities for risk ‘closure’ i.e. thedevelopment of a specific plan to deal with a specific risk issue.(APM 2000)

Experience has shown that qualitative analysis – identifying andassessing risks – usually leads to an initial, if simple, level of quantitative analysis. If, for any reason- such as time or resource pressure or cost constraints- both a qualitative and quantitative analysis are impossible, it is the qualitative analysis that should remain.(APM 2000)

2.1.3.2Risk Management

There are numerous definitions of Risk Management offered by the various professional institutions and standards bodies. The differences in definition are largely a matter of semantics and terminology.

The BSI guide defines risk management as "Coordinated activities to direct and control an organization with regards to risk and generally includes risk assessment, risk treatment, risk acceptance, and risk communication" (BSI Guide 73 2002)

The Project Management Institute also describes risk management as "the systematic process of identifying, analyzing and responding to project risk. It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of events adverse to project objectives. It includes processes of Risk Management Planning, Risk Identification, Qualitative Risk Analysis, Quantitative Risk Analysis, Risk Response Planning and Risk Monitoring and Control."(Project Management Institute 2000)

According to the Construction Industry Development Board, risk management is an iterative process consisting of well-defined steps which, when taken in sequence, support better decision-making by contributing a greater insight into risks and their impacts. They assert that the risk management process can be applied to any situation where an undesired or unexpected outcome could be significant or where opportunities are identified. They also recognize risk management as an integral part of good management practice. Risk management enables continual improvement in decision- making. It is as much about identifying opportunities as avoiding or mitigating losses.(Construction Industry Development Board 2004)

From the point of view of the Association of Project Management, risk management often involves:

- Identifying preventive measures to avoid a risk or to reduce its effect
- Establishing contingency plans to deal with risks if they should occur
- Initiating further investigations to reduce uncertainty through better information
- Considering risk transfer to insurers
- Considering risk allocation in contracts
- Setting contingencies in cost estimates, float in programmes and tolerances or 'space in performance specifications'.(APM 2000)

2.2 BENEFITSOFPROJECTRISKANALYSISANDMANAGEMENT (PRAM)

There are many reasons for using PRAM, but the main reason is that it can provide significant benefits far in excess of the cost of performing it.The benefits gained from using PRAM serve not only the project but also other parties such as the organization and its customers. Some examples of the main benefits are:

- An increased understanding of the project, which in turn leads to the formulation of more realistic plans, in terms of both cost estimates and timescales
- An increased understanding of the risks in a project and their possible impact, which can lead to the minimization of risks for a party and/ or the allocation of risks to the party best able to handle them

- An understanding of how risks in a project can lead to the use of a more suitable type of contract
- An independent view of the project risks which can help to justify decisions and enable more efficient and effective management of the risks
- A knowledge of the risks in a project which allows assessment of contingencies that actually reflect the risks and which also tends to discourage the acceptance of financially unsound projects
- A contribution to the build-up of statistical information of historical information of historical risk that will assist in better modeling of future projects
- Facilitation of greater, but more rational, risk taking, thus increasing the benefits that can be gained from risk taking
- Assistance in the distinction between management and bad luck and bad management.

2.3 RISKAND THENATURE OF THECONSTRUCTIONPROJECT

2.3.1 Introduction

It is said that the construction industry is exposed to more risk and uncertainty than perhaps any other industry. (Flanagan and Norman 1993). If the above assertion is accepted there can be little argument that RM has a very important part to play in project success. It is however important to evaluate the validity of the foregoing statement and to attempt to ascertain why construction is so exposed to risk in such a manner as is different from other industries.

All construction projects can be said to have both homogeneous and heterogeneous characteristics- they exhibit both similarities and differences from project to project. It is the degree of uniqueness inherent in any given project that strongly influences the amount of associated risk and uncertainty.

2.3.2 Project Heterogeneity

No two projects are the same, no matter how similar they appear. There is likely to be truly different situations and circumstances that arise from project to project, no matter what. Where such heterogeneity exists in the design, construction, and management of projects there will be by definition, more uncertainty about the outcome of the events or situations. The project team faces greater uncertainty because of the lack of directly relevant past experience, information, knowledge and understanding. Correspondingly, there is a higher degree of risk.

2.3.3 Project Homogeneity

With other industries, such as manufacturing, there is mass production of identical products with little variability to affect the process outcomes. Hence quality control and productivity are much more predictable, tightly defined and the process can be made to be very efficient. There are no unknowns and little risk involved in the production process. Construction is, however, different and cannot achieve the same degree of certainty and productivity associated with such a scenario.

It is clear from the foregoing argument that the more homogeneous the process and product, the less the uncertainty, and hence the less the risk involved. It follows therefore that it is more desirable for projects to be homogeneous since there would be less risk to manage and greater confidence that project objectives could be achieved.

2.3.4Project Similarities

Project similarities generally arise from similarities in: structural elements (foundations, walls, roof, finishes, etc); construction materials; construction components; site operations; management structure and style.

2.3.5 Project Differences

Project differences arise from factors such as: site and site conditions; element specifications; management structure and style; sources of labour plant and materials.

Raftery observed that despite largely common activities and processes, each construction project is assembled and constructed on its own site with its own physical characteristics, subject to weather conditions depending on the season, with different material specifications and technical solutions to the problem of enclosing space. While a number of materials and components will be identical, many will not. Each project usually has a different labour force of operatives and managers. Hence there will be differences in the management and interpersonal behavior on each project simply because people are different. (Raftery 1994)

2.4 THE BID- NO- BID DECISION

2.4.1 General Decision Making

A decision may be defined as “The action of deciding, settlement, determination, the final and definite result of examining, the making up of one’s mind on any point or on a course of action; a resolution(Oxford English Dictionary 1961)):(Hohoabu 1999))

The classic business decision-making theory defined by Herbert Simon suggests there are four main stages in decision making:

a) Intelligence. At this stage awareness occurs that a problem exists and that it must be solved.
b) Design. Alternative solutions are identified and reviewed. The risk and benefits of different approaches to solving the problem are considered.
c) Choice. The decision is made by selection of the best solution
d) Implementation. The decision is supplemented and reviewed for its success There is overlap between each stage and the manager may iterate through all of these stages until the best decision is made.((Simon 1955): (Chaffey and Wood 2005)

More recent decision-making theory suggests five steps in the process, namely:

a) Problem definition
b) Identification of alternatives
c) Determination of the evaluation criteria
d) Evaluation of the alternatives
e) Choosing of an alternative. (Anderson, J and Williams 2003)

The decision-making process may take two basic forms: qualitative and quantitative.

Quantitative analysis is based primarily on the manager's judgement and experience; it includes the manager's intuitive "feel" for the problem and is more an art than a science. If the manager has had experience with similar problems, or if the problem is relatively simple, heavy emphasis maybe placed upon a qualitative analysis. However, if the manager has little experience with similar problems, or if the problem is sufficiently complex, then a quantitative analysis of the problem can be an especially important consideration in the manager's final decision.

When using the quantitative approach, an analyst will concentrate on the quantitative facts or data associated with the problem and develop mathematical expressions that describe the objectives, constraints and other relationships that exist in the problem. Then by using one or more quantitative methods, the analyst will make a recommendation based on the quantitative aspects of the problem. A manager who is knowledgeable in quantitative decision-making procedures is in a much better position to compare and evaluate the qualitative and quantitative sources of recommendations and ultimately combine the two sources in order to make the best possible decision.(Anderson, J and Williams 2003)

Decision making has become especially challenging in recent times because it's an era of accelerating change where the pace of decision making has accelerated. According to Toffler, "the very speed of change introduces a new element into management, forcing executives already nervous in an unfamiliar environment to make more and more decisions at a faster and faster pace. Response times are honed to a minimum."(Toffler 1980). The decision making process, therefore in dealing with the acceleration effect now presents an even tougher challenge to decision makers of today. (Hohoabu 1999)

Leigh purported that one of the most popular intellectual pastimes of managers is to dream up new ways of fragmenting the decision process, attempting to form discrete easy –to-understand stage. These are aimed at providing a framework which will guide managers in dealing with all forms of decisions and generally have two things in common:

a) A belief that the decision making process is central to the role of management
b) Decision making should be a rational series of predetermined steps.

However, because there is uncertainty as to how human beings make decisions, the justification for any particular form of decision framework as a prescriptive tool is limited.((Leigh 1983)((Hohoabu 1999))).

2.4.2 The Decision to Bid

Strategic decisions define the boundary between a construction company and its external environment. Contract bidding like all forms of pricing is essentially about contractors making strategic decisions in respect of which contracts to bid for, and the bid levels necessary to secure the selected contracts, in the light of limited resources(Hohoabu 1999)

Most contractors recognize that they cannot undertake work in all sectors of the market, and as part of their corporate strategy, define a strategic domain that sets parameters within which senior management can operate. This may vary from a narrow domain in which bidders specialize in certain contract characteristics such as type, location to a broad domain which encompasses understanding both building and civil engineering work.(Male 1991)

The strategic domain defines market dimensions with which contractors plan to operate. This includes making decisions on which contract types and sizes to compete for and the extent of geographical area over which to undertake the construction and determining the company's economic radius of operation

The decision to bid is the starting point of the whole bid process. A contractor receives most of the opportunities to bid through being invited from selected lists or by responding to advertisements.

The importance of the bid-no-bid decision emanates from the fact that it has profound effects on the day-to-day operations and the long term performance of the construction company. Each project a contractor chooses not to bid for might represent an opportunity loss. On the other hand, if the contractor decides to bid on a particular project, it may mean the exclusion of other potentially profitable projects due to the fact, stated earlier, that contractors cannot bid for all projects due to time and resource limitations. This results in some opportunity costs as well. Also, the direct and indirect costs of the bidding process for the project will have to be estimated. Bidding for any project contract requires the preparation of an estimate, which in turn, requires the commitment of resources such as: purchase of bidding documents, bid securities, and estimating personnel. The process can be a significant expense to the contractor's firm, and hence the decision to bid must be made judiciously to ensure that the firm bids for "winnable" and profitable projects in order to absorb the costs of bidding.

According to (Hohoabu 1999), an inappropriate bid-no-bid decision could result in:

a. The submission of less- than -accurate bid
b. Avoidable failed bids
c. Bids becoming successful only to realize that :
    - The project is not suitable to the company's business plan and could overstretch the company's resources.
    - The contractor will have to execute the work under unfavorable contract conditions or with clients' representatives, nominated subcontractors and / or suppliers, whose actions can affect the project's execution and profitability.
    - The financial status of the client is doubtful
    - They have to work under unfavorable site and environmental conditions
    - They have a large contract in which value of own work is small, leading to underutilization of their work force, and/or problem with keeping subcontractors to their programme dates

Bid decision making is thus a very important factor in determining the success or failure of a contractor's business.However, he bid/ no bid decision can be very complex due to the following elements:

- The consequences of each alternative are uncertain (this uncertainty rules out any guarantee that the best outcome is obtained) ((Shash 1993): ((Hohoabu 1999))
- The large number of factors having considerable effect on this decision

The complexity associated with the bid/ no bid decision suggests the use of a modeling technique to develop representative models that will aid contractors make a proper choice. The development of such a model will require the identification of the factors influencing such decisions.

2.4.3 Risk and The Bid/ No Bid Decision

Due to the significance of the bid/ no bid decision, and the uncertainty of its outcome, it becomes an important source of risk to the contractor's business, and which must be managed in order to achieve the objectives of the construction firm.

Essentially, every decision to bid (or not to bid) for a project has consequences on the contractor's company, as earlier described. Each project the company successfully bids for may result in either a profit or loss. It may either contribute to failure, or success. Hence in deciding to bid, the contractor is taking a risk for a potential return (profit or loss). The bidding decision hence becomes essentially a risk- return evaluation.(Chandra 2006)observed that "Often managers look at risk and return characteristics of a project and decide judgementally whether the project should be accepted or rejected."

Due to recent advances in the area of estimating, it is now possible to estimate, with a degree of certainty, the possible/likely returns of proposed projects, but the quantification of risks is a much more daunting task to achieve. It is however important for the bidder to evaluate the "riskiness" of a proposed project and to balance it against the potential returns of the project in order to inform the bidding decision. The purpose of this study is to develop and propose a simple model that assignsrisk ratings to projects as a guide to bidding decision making by Ghanaian construction firms.

2.4.4 Factors Affecting the Influencing Decision to Bid

The literature surveyed presents a number of factors regarded by some authors as influential in making project selection decisions. After sampling seventeen authors,(Odusote 1992)identified forty-two (42) of such factors. Within the individual factors, there was little agreement among the authors, with only 14 factors being mentioned by 29% of the authors. No single factor was mentioned by all the authors.

The factors identified fell into five broad categories, namely:

1.The "Project Characteristics Category", which includes all qualities that describe the project such as value, owner's identity, duration, location etc.

2.The "Project Document Category" , which constitutes all factors and characteristics of the bidding documents such as type of contract, quality of bid information

3.The "Company Characteristics Category" which includes factors relevant to the company such as current workload, experience in similar projects

4.The "Bidding Situation Category, which comprises all factors operating in the award of contract situation, including: competition, bid selection criteria, number of bidders.

5.The “Economic Situation Category”, which involves all macroeconomic factors that may affect the project e.g. government policy, inflation.

A contractor’s bid/ nobid decision is, therefore affected by a variety of factors: both external and internal. Various divergent views, however, have been expressed by authors on these factors.

Drew et al (Drew and Martin 1997)) was of the view that contractors in deciding to bid will likely consider both their current workload and future availability of work in the construction market. Their belief has roots in the economic theory of a firm, which suggests that firms are most efficient when they operate just under capacity and that if they try to operate beyond this point, they may run into assorted bottlenecks that may make them less competitive. Milne (Milne 1980)observed that bidding and accepting work without adequate financial, managerial, or manpower resources will likely result in excessive work load which in turn will likely lead to a lack of control, low return and possible losses. Smith(R.C. 1986)discussed the danger of “over-trading” which is often a possibility associated with increased turnover. He believed that when a contractor becomes overstretchedfinancially and technically, the result is inefficiency and imminent disaster for his firm.

This “workload theory” even though plausible, fails to consider other wider bid, and management related issues such as competition and project funding, which can hinder a contractor’s success at bid , or successful execution of the project. Ahuja(Ahuja and Arunachalam 1984)agreed that contractors’ construction capacity was important in making project selection decisions but thought that risks associated with five (5) other factors such as long term company goals, macroeconomic factors, nature of business, location of new project, and owner’s reputation should also be considered. Cooke (Placeholder9) and AmoahMensah(K.

1995) also cited a multiplicity of factors for the contractor to consider in an attempt to formulate a good bidding policy by taking a broader outlook.

This broader outlook view is also presented by McCaffer et al(McCaffer and Harris 2005) when they argued that the decision of a contractor to submit a bid should result from the implementation of a company's bidding policy formulated from trading and marketing information such as:

a. Turnover target, divided to show in which markets and what proportions the total turnover can be obtained
b. Overheads budget
c. Gross and net project targets
d. Anticipated volume of inquiries required to achieve the targeted turnover.(McCaffer and Harris 2005)The contractor must, in the process,

a. Determine whether he has adequate resources and experience to tackle the project
b. Determine the seriousness of the client and the security of the finance for the project
c. Determine the risk involved in the contract and the risks the contractor will be asked to bear as defined in the conditions of contract.

2.4.5 Previous Research Findings on Bid/ No Bid Decisions

Ahmad et al (Ahmad and Minkarah 1988) identified thirty-0ne (31) factors affecting bidding decisions of top US Contractors.They found the most influential of them to be: type of job, owner, location, size of job, current workload and strength of the firm. They also found that bidding decisions were taken in a largely subjective manner, sometimes without reliable basis leading to mistakes and subsequent losses to construction firms and the industry at large. Odusote and Fellows (Odusote 1992), based on a survey of some large UK contractors, established that client-related factors that is,"ability of the client to pay" ranked 1st, "good relationship with important regular clients" ranked 3rd and the "ability to provide client satisfaction" ranked 4th, were the most influential factors. "Type of work" was ranked 2nd. They discovered that the contractors did not attach too much importance to availability of physical resources, because resource constraints could be easily overcome through alternative sources such as hiring, leasing and subcontracting. Also the contractors studied did not regard their financial resources as a very important factor, as they saw the provision of financial resources as the client's responsibility. They believed that most of that problem was solved once the identity, reputation, financial standing, and ability of the client to pay for the project costs had been established.

Shash surveyed top UK contractors and established that the contractor's need for work, number of competitors bidding, and experience in such projects were three (3) most important factors influencing project selection.(Shash 1993)

Bajaj(Bajaj and D 1997) also surveyed contractors in New South Wales, Australia, and identified five (5) broad issues affecting project selection decisions. These issues are:

a. Type of project which includes suitability of project to company business plan
b. Bid-related issues which include bidding procedure, number of bidders, time to bid, load of estimating department, bid selection criteria, and bidding organization or client.
c. Finance-related issues, which include: client finance guarantee, financial status of client, project funding, and amount of security or guarantee required from the contractor.
d. Contract-related issues which include contract conditions, quality of documentation.

e. Management-related issues which include current workload, availability of key construction personnel within the company, management experience with the type of project.

His research work further established that issues related to bidding, and types of project were the most influential of all.

A study by Hohoabu(Hohoabu 1999)on the major factors influencing the bid/ no bid decisions of some top contractors in Ghana revealed that no factor was singly predominant in controlling project selection decisions of Ghanaian contractors. His study identified ten factors as major influences on the bid/no bid decisions of General Building category D1 and D2 contractors in Ghana. These factors fell under two categories as follows:

a. Project Characteristics category

- Ability of the client to pay for work done
- Location of project
- Value of project
- Identity and reputation of client
- Contract profitability
- Type of work
- Promoting of contractor’s image

b. Company Characteristics category

- Physical resources to execute project
- Financial resources to execute project
- Workload

His study showed that contractors lay greater emphasis on factors falling under the project characteristics category, and to a limited extent, the company characteristics category, when taking bid/ no bid decisions, thus relegating the factors relating to bid documents, bidding, and economic situation,to the background. The highest ranked project characteristic factor was, "the ability of the client to pay for work done".

Other relevant findings of his study included the following:

- Construction companies in Ghana rely heavily on quantity surveyors in making their bid/ no bid decisions (65% of respondents indicated that the Managing Director took the decision in consultation with the Quantity Surveyor/Estimator, 7% a bidding board comprising of both the Managing Director and Quantity Surveyor among others, whereas 1% indicated the decision as solely by the Quantity Surveyor).
- Contractors in Ghana relied solely on mental judgement, based on assessment of various bidding factors, rather than on mathematical or computer models, in making their bid/ no bid decisions. Such mental judgements are often subjective and influenced by experience and perception.

2.4.6 Decision Models

Various mathematical models have been developed with the aim of assisting the contractor in making objective bid/ no bid decisions.

(R.F and D.A. 1980)); (Hohoabu 1999)examined the application of decision theory to bidding. In their study, they addressed the question of quantification by using statistical probability through the medium of decision analysis.

Ahuja proposed a simulation model to aid in the bid/ no- bid decision. He stated that before proceeding with bid preparation, projects under consideration should be scrutinized to evaluate the risk due to each of the following factors that influence the selection decision:

- Long term company goals
- Condition of local and national economy
- Nature of business
- Location of new project
- Reputation of client
- Contractors’ construction capacity

Any prospective bid that satisfied the first five factors had to be evaluated for risk due to the sixth factor, i.e. the contractor’s construction capacity. He proposed a model that modified the conventional resources allocation procedure to take into account the different natures of uncertainties associated with resources availability. ((Ahuja and Arunachalan 1984) : (Hohoabu 1999))

Eastham proposed a weighted model for aiding bid/ no- bid decisions. He believed there was a hierarchy of influence which exists within the construction operational environment. This comprises two quite independent factors classified by the degree of control which the contractor can apply to each and may be expressed as:-

a) Indirect factors over which the contractor has no control, such as Government policy, economic, and technological trends.

b) Direct factors which include the availability of financial resources planning, input, and output markets. It is within input and output markets that the perception of client interest may be examined.

He argued that the decision to bid revolved around "Resources" and "Job desirability", which were each influenced by objective decisions, whose effects can be accurately quantified as well as subjective decisions which could not be accurately quantified. The objective decisions focused on human resources, time, materials, etc, whereas subjective decisions were based on abstract intangibles like design team, competitors, probabilityof success etc. He assigned different weightings to these two types of decisions to guide contractors in decision making.(Eastham 1987) . Ahmad proposed a decision support system for modeling bid/no bid decision problems. This model was based on the techniques of decision analysis and a set of attributes obtained as a result of the questionnaire survey presented in Ahmad et al (Ahmad and Minkarah 1988).

Chandra(Chandra 2006) suggests that when a firm evaluates a large number of project options regularly, it may be helpful to streamline the process of preliminary screening. He suggested that a preliminary evaluation could be translated into a project rating index. The steps involved in determining the project rating index were as follows:

- Identify factors relevant for project rating
- Assign weights to these factors (the weights are supposed to reflect their relative importance.)
- Rate the proposed project on various factors using a suitable rating scale. (Typically a 5-point scale or 7-point scale is used for this purpose.)

- For each factor, multiply the factor rating with the factor weight to get the factor score
- Add all the factor scores to get the overall project rating index. (Chandra 2006)

This study attempts to combine the project rating index system suggested by Chandra above and the concept used by Ahuja's model (previously discussed) to develop and propose a model that can help Ghanaian contractors classify potential proposed construction projects in terms of their overall riskiness. The model will enable the contractors to assign a risk rating index to each proposed project, and rank them accordingly. This is expected to be of tremendous help to local contractors in project selection, as the decision can then be reduced to a simpler risk/ return commercial evaluation. As outlined throughout this research, there are several other project characteristics, that may influence the decision to bid/ no bid decision, but it can be argued that all these factors can be evaluated, for the sake of simplicity and practicality, in terms of their contributions to the overall riskiness of the project. According to Chandra, "The desirability of a project is critically dependent on the risk characterizing it."(Chandra 2006)

In order to establish a project risk rating index, it is important to develop a checklist of factors that can be used to assess the overall riskiness of a "typical" construction project. (University, Heriot-Watt 2004)This checklist of factors influencing risk will then be modeled using the procedure suggested by Chandra (above) to provide an overall project rating index for each proposed project.

One such checklist of project risk factors presented at the Heriot –Watt University is outlined in Table 1 below, and will be used as a framework platform for researching the actual factors that influence project riskiness in the Ghanaian context. The table below shows a range of technical,commercial and managerial factors against which risk can be assessed. Riskier projects will have a greater number of drivers assessed at a higher risk rating. (University, Heriot-Watt 2004)

A detailed outlineof the data collection and research methodology to be adopted for this research study follows in the next chapter.

CHAPTER THREE

RESEARCH METHODOLOGY AND DATA COLLECTION

3.1 GENERAL

The proposed research project took the form of a literature review on the relevant subject matter, followed by a survey of contractors and other construction professionals familiar with the dynamics of the bidding decision processes used by Ghanaian Construction Firms.

The survey took the form of sets of questionnaire which were administered to the selected respondents. The questions therein were designed to achieve the following:

- Identify the factors that influence the risk perception of construction projects in the Ghanaian context.
- Rank each factor according to importance
- Determine the relative weightings of the afore-mentioned factors
- Ascertain the general perception of, and attitude towards, formal project risk analysis, within the Ghanaian construction industry, especially at the pre-bid stage.
- Identify the factors that motivate Ghanaian construction organizations to adopt formal project risk analysis during the bidding decision process.

A sample of thequestionnaires used for this study is included in Appendix A. The information gathered during the proposed survey was used to guide the development of a conceptual model for determining the ‘‘risk rating” of proposed projects, with the view to inform the bid/no-bid decision. A discussion of the proposed questionnaire now follows.

3.2 BASES FOR DEVELOPMENT OF QUESTIONNAIRE

The proposed questionnaire will be divided into four main sections: The Introduction; Section 1; Section 2; and Section 3.

A discussion of the contents of the respective section follows hereby.

The "Introduction" section provides a brief background to the research project, and explains the purpose of the survey. It also provides general instructions to help respondents answer the questions.

"Section 1" consists of a set of questions (1-5) aimed at establishing the general professional background and familiarity of the respondent with the research topic. Question 5 seeks to establish the respondent's perspective on the need for 'formal risk analysis' approach to be adopted during the bidding decision process.

"Section 2" shows a table of the proposed project risk perception factors adapted from a similar table developed at the Heriot Watt University in Scotland(University, Heriot-Watt 2004)This table was selected from among several options reviewed, because it best dealt with factors depicting the decision dynamics at "the Pre-bid stage". This section also includes questions 6 through 8, each of which provides guiding instructions on how to complete the factor table by attaching "weightings" and rankings to the respective factors.

Question 6 instructs the respondent to add to the table any additional factors which they consider important, but may have been omitted from the table. Question 7 directs the respondents to rank the respective factors in order of increasing importance, whilst Question 8 directs them to assign relative weightings to the listed factors on a scale of 1 through 10, commensurate with their perceived importance

The purpose of this section is to survey the opinions of respondents on the relevant factors affecting the risk perception of construction projects at the Pre-bid stage, and to ascertain the relative weightings and rankings of these factors.

"SECTION 3" consists of questions 9 and 10 which attempt to solicit the opinion of the respondent on importance of project risk perception in making the decision to bid or not to bid. Question 10 also allows the respondent to give an opinion of the potential usefulness of the proposed model.

3.3 SAMPLING PROCESS

The target population for the research study will be Construction experts from recognized construction firms and will include contractors' representatives, construction consultants, and project managers in the Ghanaian construction industry. Due to time and resource constraints the distribution of questionnaires will be limited to the Greater Accra and Ashanti regions.

Also, due to the similar reasons, the 'Snowball' sampling method will be used to select potential respondents. It is a type of purposive sampling procedure. With this method the researcher begins by identifying a small number of people who meet the criteria for inclusion in the study. He/she then asks them to recommend others who they may know, who also meet the criteria. Although this method would hardly lead to representative samples, there are times when it may be the best method available. It is especially useful when you are trying to reach a population that is inaccessible or hard to find.(Web Center for Social Research Methods n.d.).

The sample size is calculated in the following formula:

(Kish, 1965)

$$\text{This is given by } n = \frac{n^1}{(1 + n^1/N)}$$

Where N = total population

$n^1 = \frac{S^2}{V^2}$

n = Sample size

v = Standard error of sampling distribution = 0.05

s = Maximum standard deviation of the population elements. (Total error = 0.1 at a confidence level of 95%)

s^2 = p (1-p) = 0.5(1 – 0.5) = 0.25

p = the proportion of population elements that belong to the defined class

3.4 DATA ANALYSES

This section discusses how the questionnaire responses will be analysed. First the overall response rate for the questionnaires will be tabulated, and the respective response rates for each category of respondent will be derived and analysed. Second, the responses to questions in Section 1 will be subjected to a similar procedure and the results analysed based on the number of respondents and percentage of respondents.

Section 2 involves analyzing the factor table results. A simple average calculation will be applied to the total responses for the Factor Ranking column (Column B), to obtain the average ranking of each factor as follows:

$$\text{Average Factor Ranking} = \frac{\Sigma R}{N}$$

Where R = the factor ranking (ranging from 1 through 30)assigned by each respondent for a particular factor.

N = the total number of responses for that particular factor.

The 'Factor Weighting' column was evaluated using the Relative Importance Index formula for all factors. This will help develop a final number (weighting index), which is an overall estimate of the relative weighting (importance) of the factor. Using the index we can compare the relative importance of different factors, and can input these indices into our proposed model to help develop an overall quantitative risk perception index which can be compared to a scale to determine the overall risk perception of the project. (James, 2007)

The formula for the Relative importance index is:

$$\frac{\Sigma W}{A \times N} \qquad 0 \leq index \leq 1$$

Where W = Weighting (ranging from 1 through 5 in order of increasing importance) given to each factor by respondents.

A = Highest weight (i.e. 5 in this case)

N = Total number of respondents

Section 3, which includes responses to questions 9 and 10, was tabulated and analyzed in the same manner as Section 1.

3.5RESPONSE RATE

Table 1: Table of Findings

Respondents	Questionnaire sent out	Questionnaires returned	Percentage returned
Architects			
Architects & Construction Project Manager			
Contractor / Project Manager			
Civil Engineer			
Civil Engineer, Contractor/ Project Manager			
Contractor's Quantity Surveyor			
Consulting QS & Contractor's QS			
Consulting QS			

CHAPTER FOUR

ANALYSIS AND DISCUSSION OF RESULTS

4.1INTRODUCTION

Several key demographic characteristics of valid respondents are reported in this section as well as the groupings of some variables (factors). Mostly, the data from the survey were categorical data; therefore, basic frequencies with bar charts for the demographic characteristics and relative importance index and factor analysis were used for the groupings to determine the predominant project risk factors.

Technically, only respondents who were construction professionals, had reasonable years of working experience, had played active roles in bidding decision process of construction firms, some of who had some experience in using formal risk analysis in bidding decision processes for construction projects in Ghana were selected in the final valid sample. These respondents' responses served as key inputs for developing the desired simple quantitative risk model for use by Ghanaian construction organizations, to form risk perceptions of local construction projects, in order to inform their bid/ no bid decision process.

The total number of responses received was 67 out of the 110 total questionnaires sent to respondents. The response rate was therefore 61%. Responses on the demographic characteristics were 100%.

4.2 DEMOGRAPHY

Question 1:Question on respondents' professional background, the responses obtained were :

Table 2: Professional background

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ARCH	6	9.0	9.0	9.0
	ARCH,C/PM	3	4.5	4.5	13.4
	C/PM	5	7.5	7.5	20.9
	CE	7	10.4	10.4	31.3
	CE, C/PM	3	4.5	4.5	35.8
	CQS1	17	25.4	25.4	61.2
	CQS1,CQS2	11	16.4	16.4	77.6
	CQS2	15	22.4	22.4	100.0
	Total	67	100.0	100.0	

KEY/ LEGEND:

ARCH - Architect

CQS1 - Consulting Quantity Surveyor

CQS2 - Contractor's Quantity Surveyor

C/PM - Contractor /Project Manager

CE - Civil Engineer

Table 1, depicts the professional background of the respondents. Consulting Quantity Surveyor (CQS1), Contractor's Quantity Surveyor (CQS2) and those who doubled as both Consulting Quantity Surveyors (CQS1) and Contractor's Quantity Surveyor (CQS2), had the first three highest frequencies of 17, 15 and 11 respectively. These categories have their respective percentages of 25.4, 22.4 and 16.4 representing a total percentage of 64.2. The remaining 35.8% are of the category of Civil Engineer (CE) 10.4%, Architect (ARCH) 9.0%, Contractor /Project Manager (C/PM) 7.5%, Architect (ARCH) and Contractor /Project Manager (C/PM) 4.5%, and Civil Engineer (CE) and Contractor /Project Manager (C/PM) 4.5%.

The pictorial presentation below (figure 1), thus, bar chart, gives a clear picture of the respective professional categories of the respondents. The professional levels of respondents make the data reliable as the various backgrounds have their responses to the opinion on the risk factors of construction.

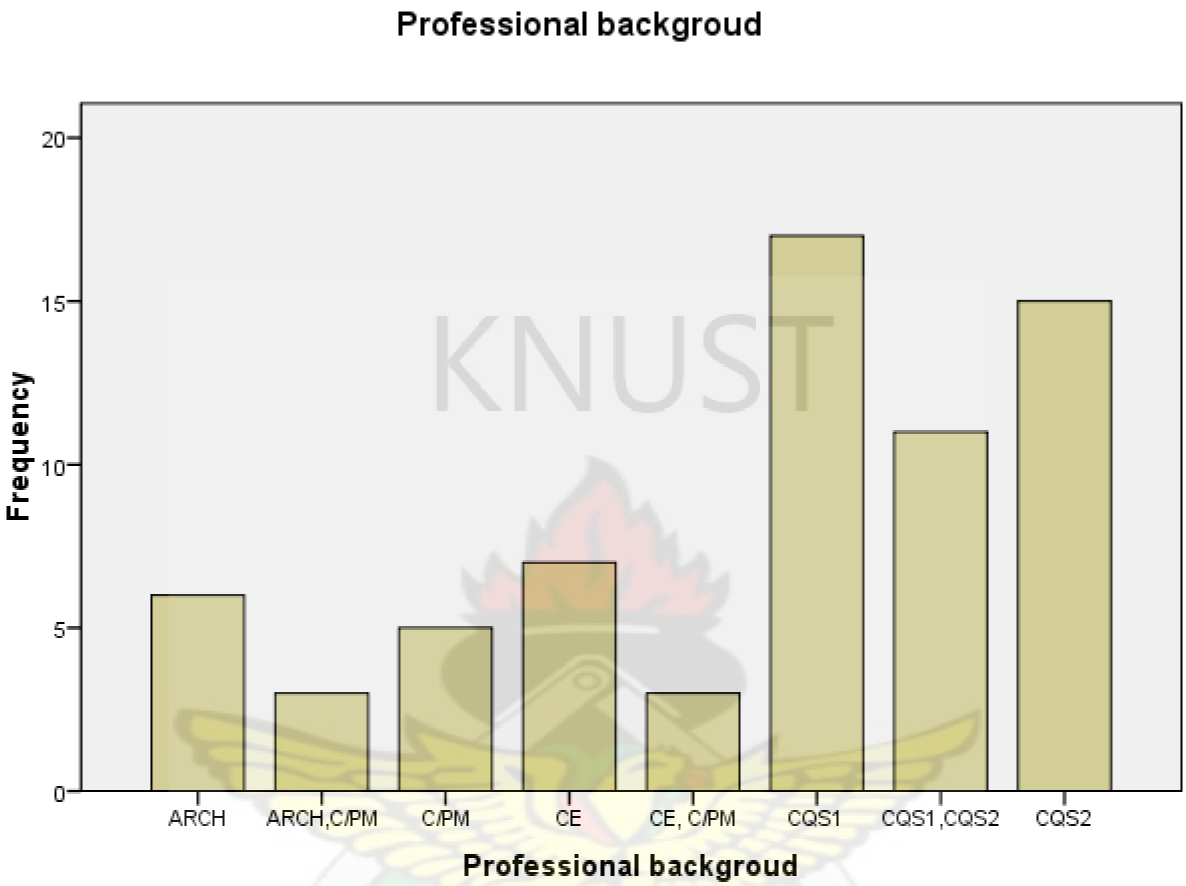
Professional backgroud
Frequency
20
15
10
5
0
ARCH
ARCH,C/PM
C/PM
CE
CE, C/PM
CQS1
CQS1,CQS2
CQS2
Professional backgroud

Figure 1

Question 2

Respondents were asked to indicate their years of experience in the construction industry and their responses were as follows:

Table 3: Years of experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5 years	7	10.4	10.4	10.4
	6-10	28	41.8	41.8	52.2
	11-15	10	14.9	14.9	67.2
	16-20	15	22.4	22.4	89.6
	> 20	7	10.4	10.4	100.0
	Total	67	100.0	100.0	

From the table above, 47.7% (approximately 48%) of the respondents' working experience in the construction industry is over 11 years. A frequency of 28 representing 41.8% have had working experience between 6-10 years, 14.9% had between 11-15 years, 22.4% had 16-20 years and 10.4% over 20 years. Respondents' with less than 6 years working experience is 10.4% which do not affect the quality of the data. This distribution of the years of experience in the construction industry makes the opinions of respondents reliable.

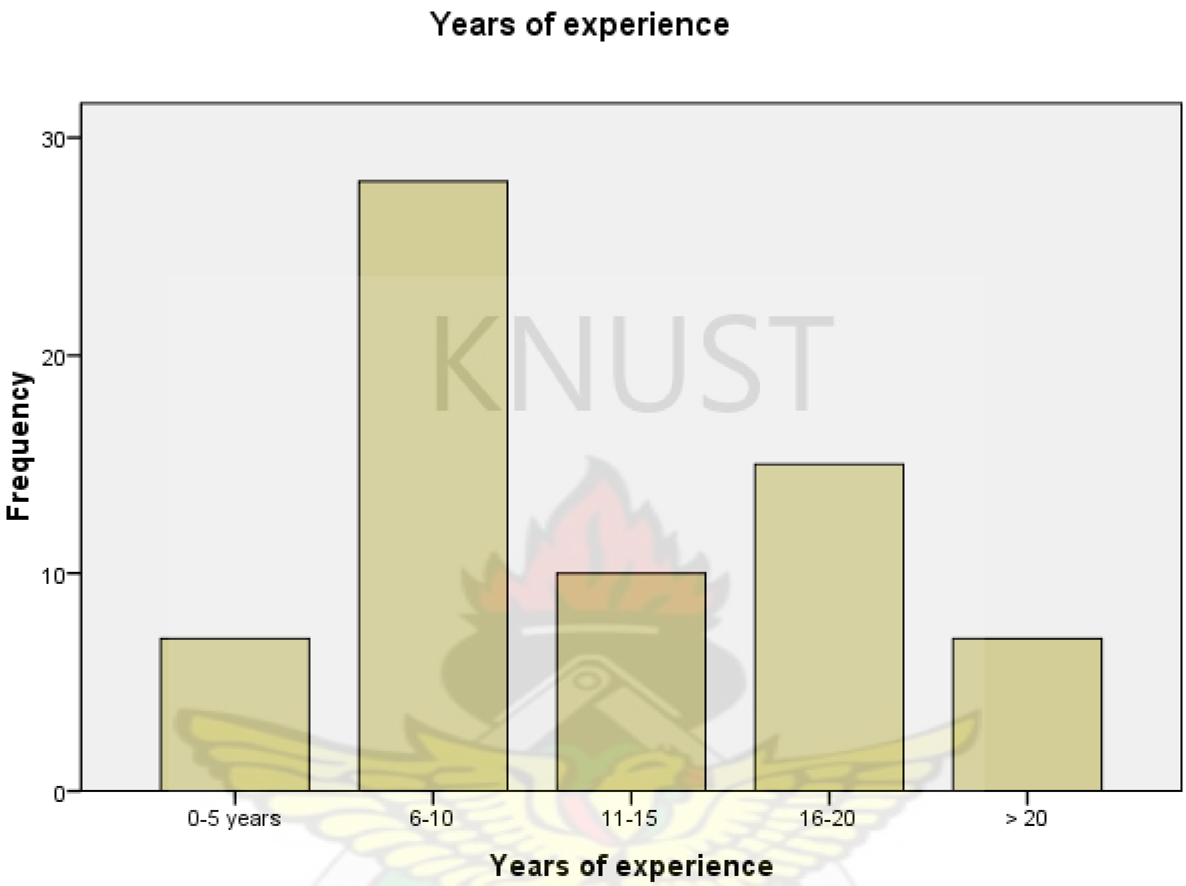
Years of experience
Frequency
30
20
10
0
0-5 years
6-10
11-15
16-20
> 20
Years of experience

Figure 2

Question 3

Respondents were asked to indicate the type of firm with which they work. The following responses were obtained:

Table 4: Type of firm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	CCF1	18	26.9	26.9	26.9
	CCF1,CCF2	9	13.4	13.4	40.3
	CCF2	35	52.2	52.2	92.5
	CCF2,ICF	1	1.5	1.5	94.0
	ICF	4	6.0	6.0	100.0
	Total	67	100.0	100.0	

CCF1 - Construction contracting firm

CCF2 - Construction consulting firm

ICF - Integrated Construction firm (e.g. Design and Build)

The majority of the respondents on the "type of firm" was from the construction consulting firm (CCF2) 52.2% with a total frequency of 35 and followed by construction contracting firm (CCF1) with a frequency and percentage of 18 and 26.9 respectively. "Bi-firms" have percentage of 13.4 and 1.5 with frequencies of 9 and 1 for construction contracting and consulting firm and construction consulting and integrated construction firm respectively. 6% of the respondents are Integrated Construction Firm (ICF).

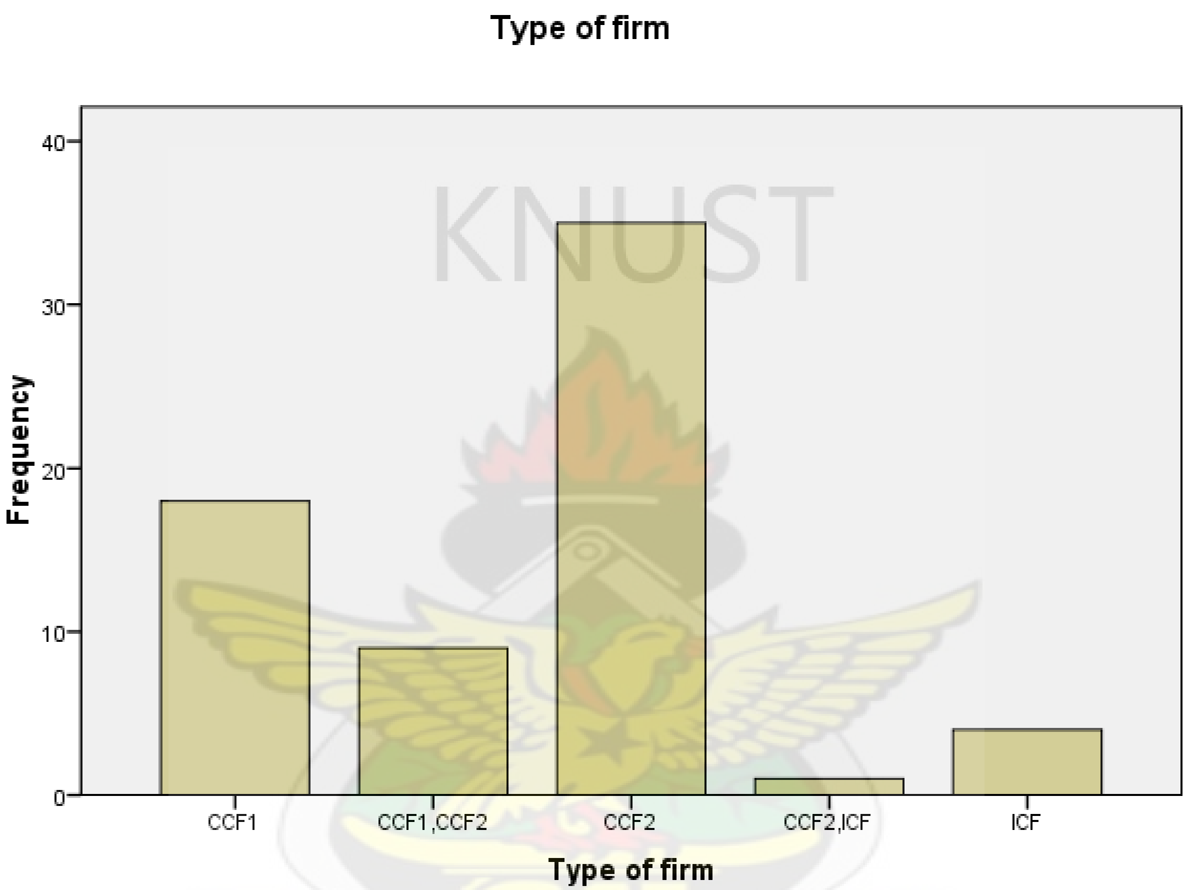

Figure 3

Question 4

Respondents were asked to indicate the range of their firm's turnover within the last 5 years, this was the response obtained;

Table 5: Range of firm's turnover within last five (5) years

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<1 million GHC	20	29.9	29.9	29.9
	1 - 2 million GHC	7	10.4	10.4	40.3
	2-3 million GHC	11	16.4	16.4	56.7
	3-4 million GHC	10	14.9	14.9	71.6
	> 4 million GHC	19	28.4	28.4	100.0
	Total	67	100.0	100.0	

On the question of the respondent's firm turnover within the last five years, 29.9% were below one million Ghana Cedis and 28.4% were above four million Ghana Cedis. This showed that, more than 50% of the respondents' firm turnovers were greater than two million Ghana Cedis within the last five years preceding the survey.

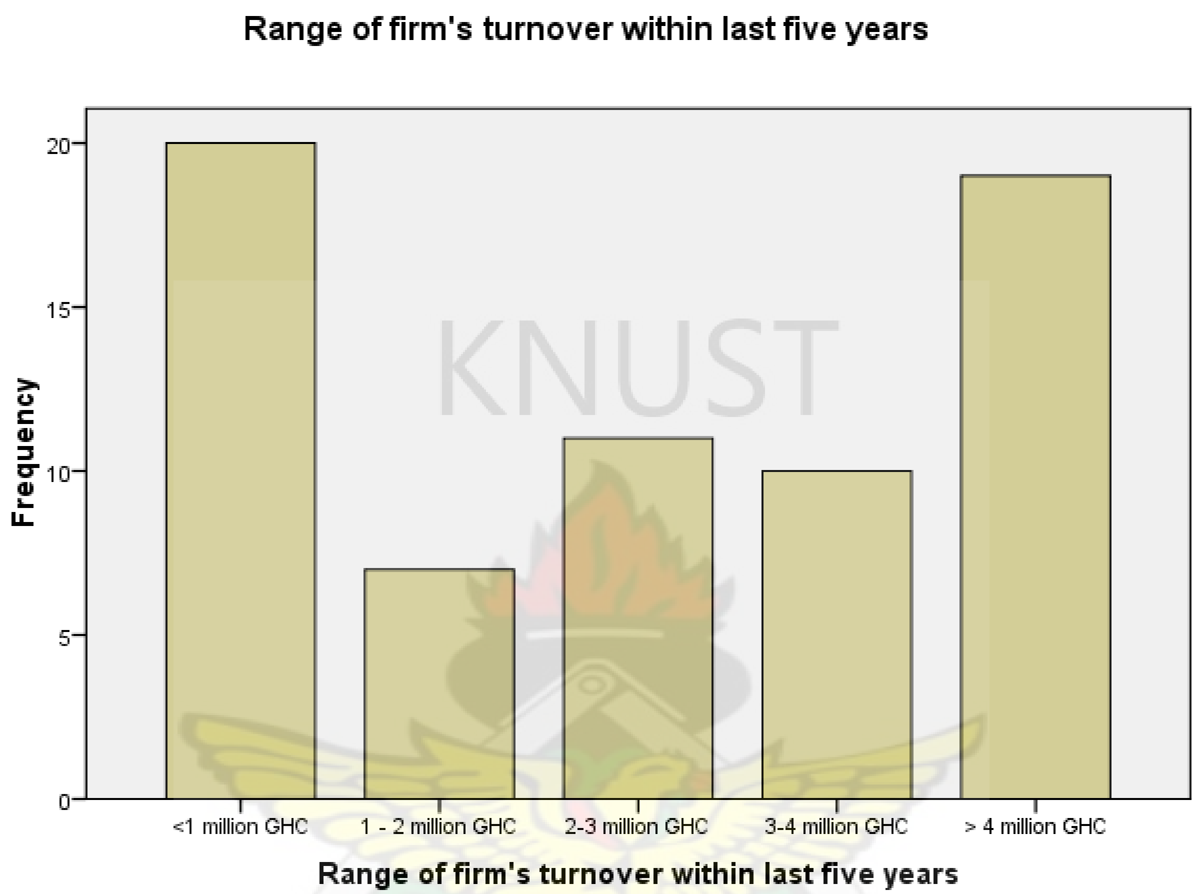
Range of firm's turnover within last five years
Frequency
20
15
10
5
0
<1 million GHC
1 - 2 million GHC
2-3 million GHC
3-4 million GHC
> 4 million GHC
Range of firm's turnover within last five years

Figure 4

Question 5

Respondents were asked whether they played an active role in the bidding decision process of a construction firm in Ghana, and the tabulated responses were as follows:

Table 6: Active role in the bidding decision process of a construction firm

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	1	1.5	1.5	1.5
	YES	66	98.5	98.5	100.0
	Total	67	100.0	100.0	

On the question of respondents' having played active role in the bidding decision process of construction firms, 98.5% said yes with only 1.5% said no. This information was helpful because it indicates that most of the respondents had valuable experience the bidding decision processes of construction firms, which fact lends more credence to their responses, and their ability to contribute to the subject matter of this research.

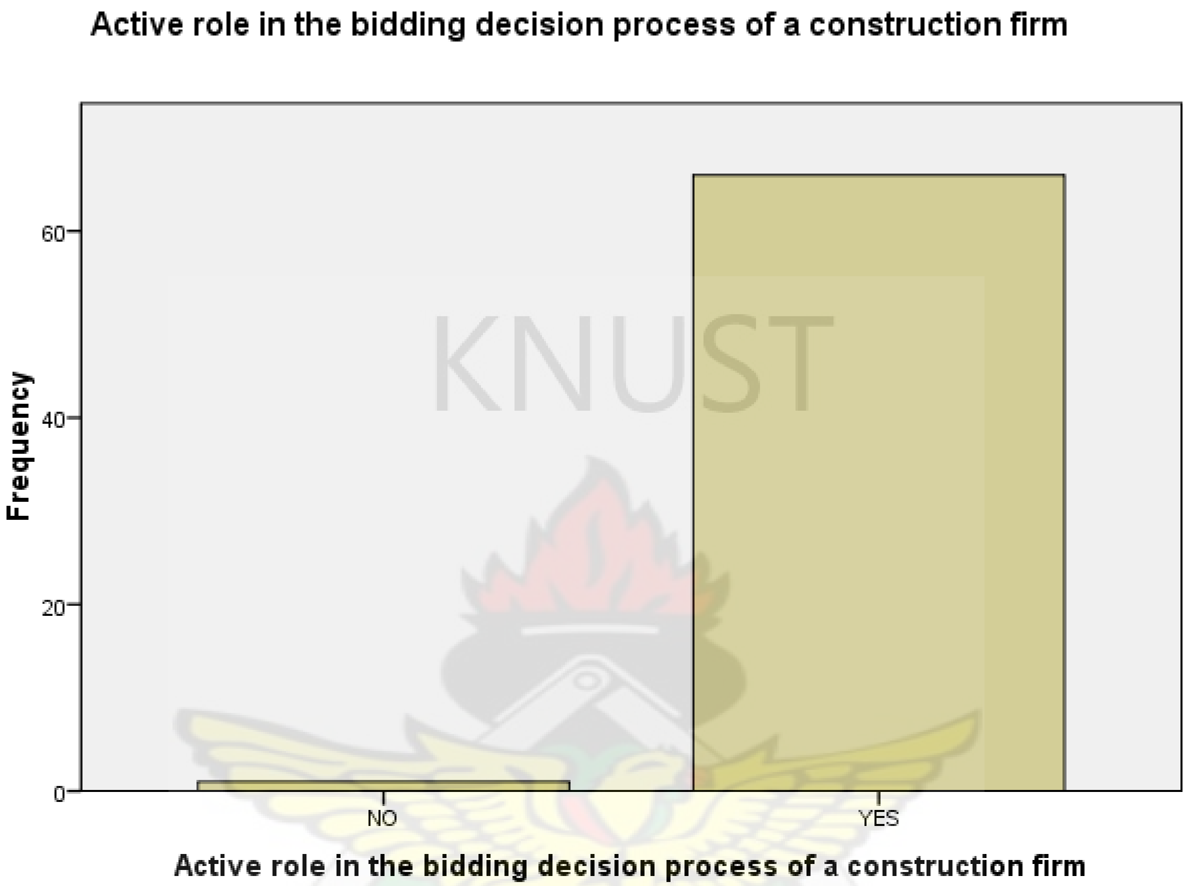
Active role in the bidding decision process of a construction firm
Frequency
60
40
20
0
NO
YES
Active role in the bidding decision process of a construction firm

Figure 5

Question 6

Respondents were asked whether from their experience they considered formal risk analysis an important part of the Ghanaian contractor's decision to bid for a project. The following table shows their responses:

Table 7: Considering formal risk analysis important (importance of formal risk analysis)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	5	7.5	7.5	7.5
	YES	62	92.5	92.5	100.0
	Total	67	100.0	100.0	

About 92.5% of the respondents' considered formal risk analysis as important issue in project bid. Given the respondents' backgrounds and respective years of experience, as depicted in the Table 2, with almost 90% having over 6 years experience, the above statistics lend a lot of credence to need for the adoption of formal risk analysis tools/ processes by construction firms in bidding decisions.

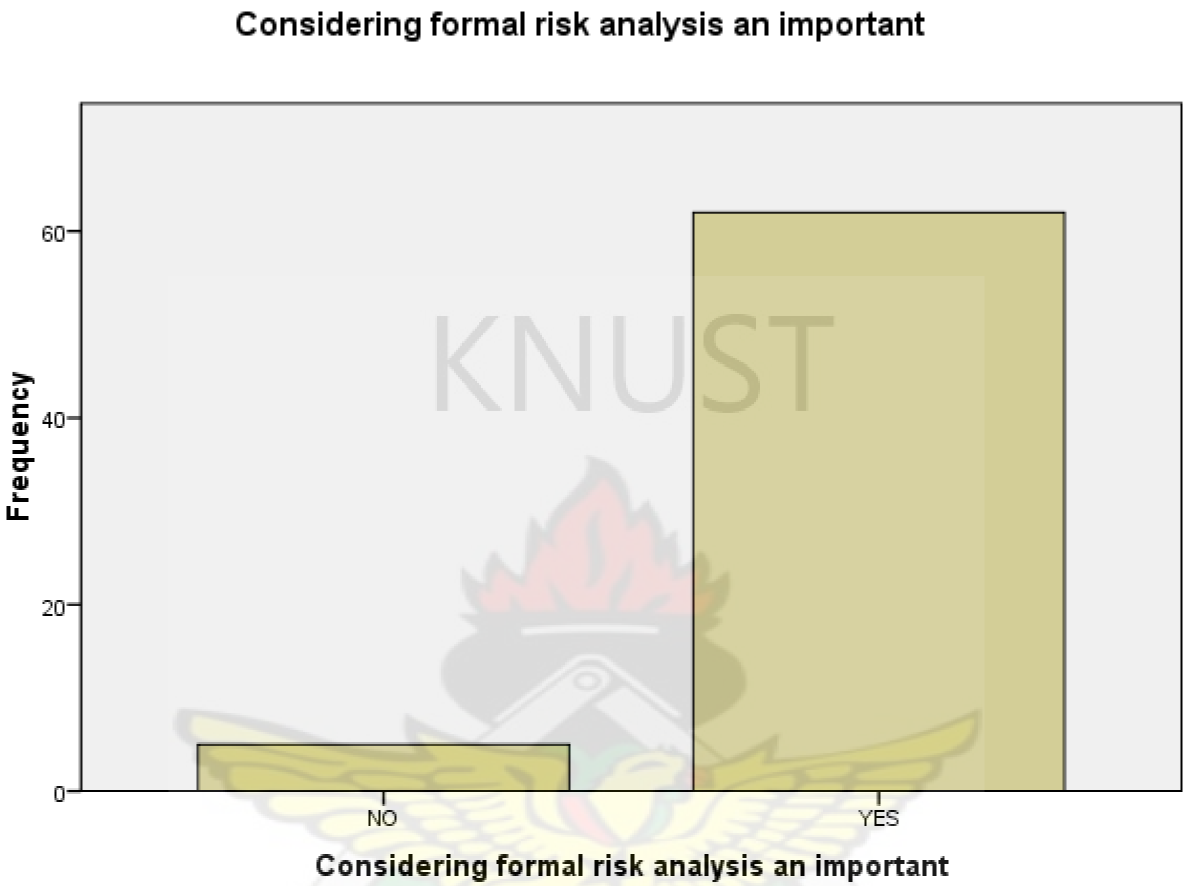

Figure 6

The descriptive statistics table is in relation with the relative importance index. Its' means values are arranged in descending order (highest to lowest). The first eight (8) factors have a mean above 3.50 and a maximum of 4.45 out of expected highest mean of 5.00. These factors are important risk factors as far as decision to bidding in construction is concerned.

4. 3 RELATIVE IMPORTANCE WEIGHTING (INDEX) AND FACTOR ANALYSIS

Relative Importance Weighting (Index)

The Relative importance weighting is split in to two, comprises of the 17 factors provided by the researcher for respondents to rate and the other one is the additional factors provided by the respondents.

Question 7 - 8

Respondents were asked to assign relative importance weightings to the respective listed factors using a scale of 0 thru 5. Table the response obtained;

Table 8a: Relative Importance Weighting for the main factors

1. RELATIVE IMPORTANCE WEIGHTING		
Factors	**Weight (%)**	**Rank**
Adequacy of funds	89%	1
Financing	88%	2
Stakeholder interest	81%	3
Uniqueness of project	79%	4
Definition of project	76%	5
Complexity of deliverable	75%	6
Procurement method	74%	7
Project location	73%	8
Project approvals	68%	9
Project surroundings	66%	10

1. RELATIVE IMPORTANCE WEIGHTING (CONT'D)		
Factors	**Weight (%)**	**Rank**
Hazardous materials	65%	11
Site availability	64%	12
Assessment of contractors	63%	13
Client relationships	59%	14
Project justification	56%	15
Consultant selection	54%	16
Client experience	42%	17

Table 8b: Relative Importance Weighting for the provisional factors

2. RELATIVE IMPORTANCE WEIGHTING		
Factors	**Weight**	**Rank**
Political influence	81%	1
Conditions of contract	63%	2
Project timing	60%	3
Project size	52%	4
Client track record	51%	5
Consultant conduct	46%	6
Competence of workforce	43%	7

Respondents were in addition to question 7-8 asked to review the factors provided, and add on any other factors that, in their opinion, influence their risk perceptions of proposed construction projects in Ghana. Table 7b above was the response obtained.

The Relative Importance Index analysis is an index that tells us how each of the questions asked are faring in relation to the other in terms of their importance. The index was used to compare the relative importance of different factors and the respective results used as input for the proposed model, to help develop overall quantitative risk perception index.

The indices were presented in percentages. They were ranked in descending order of relative importance. In general, when a factor's index equaled or exceeded 70% it was classified as highly significant. Eight (8) factors had scores within the range of 73% to 89%, (table 7a). One could see from the table weighted thus, from highest down: "Adequacy of funds" - 89%, "Financing" - 88%, "Political influence"- 81% (from table 7b), "Stakeholder interest"- 81%, "Uniqueness of project" - 79%, "Definition of project" -76%, "Complexity of deliverable" - 76%, "Procurement method"- 74% and "Project location" - 73%, the only key factors that determines the level of risk. The respondents viewed the above listed factors as most important to evaluating the risk perception of construction projects in Ghana. From the list, two factors correlate as they can be generally classified under the category of "availability of resources" namely: "adequacy of funds"; and "financing".

Factor Analysis

Table 9: Communalities

	Initial	Extraction
Uniqueness of project	1.000	.743
Complexity of deliverable	1.000	.851
Financing	1.000	.768
Adequacy of funds	1.000	.749
Project location	1.000	.769
Project surroundings	1.000	.779
Hazardous materials	1.000	.787
Definition of project	1.000	.660
Site availability	1.000	.756
Project justification	1.000	.767
Project approvals	1.000	.696
Client experience	1.000	.740
Client relationships	1.000	.829
Assessment of contractors	1.000	.791
Procurement method	1.000	.482
Consultant selection	1.000	.706
Stakeholder interest	1.000	.663

Table 9: Communalities

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Site availability	1.000	.756
Project justification	1.000	.767
Project approvals	1.000	.696
Client experience	1.000	.740
Client relationships	1.000	.829
Assessment of contractors	1.000	.791
Procurement method	1.000	.482
Consultant selection	1.000	.706
Stakeholder interest	1.000	.663

Extraction Method: Principal Component Analysis.

Table 9 is an extraction communality of factor analysis. It is an estimate of the variance in each variable accounted for by the extraction methods (Principal Component Analysis). Factors with Eigen value of more than 0.5 indicates that the variable is significant and as it approaches 1.00, the more significant the variable. From tables 8 above, the extracted components represent the variables well. Hence, generally, each variable is relatively important in evaluating the risk perception of construction projects in Ghana. The table below is a principal factor analysis which grouped the variables into eight components factors which can be used to generate model for project risk determination. This is because; the extracted factors explained the factors for about 74%.

Table 10: Total Variance Explained

Com-ponent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cum-ulative %	Total	% of Variance	Cum-ulative %	Total	% of Variance	Cum-ulative %
1	2.627	15.451	15.451	2.627	15.451	15.451	2.258	13.284	13.284
2	2.588	15.224	30.675	2.588	15.224	30.675	1.997	11.749	25.033
3	1.957	11.510	42.184	1.957	11.510	42.184	1.922	11.307	36.340
4	1.698	9.988	52.172	1.698	9.988	52.172	1.794	10.554	46.894
5	1.389	8.173	60.345	1.389	8.173	60.345	1.698	9.986	56.881
6	1.204	7.085	67.430	1.204	7.085	67.430	1.474	8.671	65.552

Com-ponent	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cum-ulative %	Total	% of Variance	Cum-ulative %	Total	% of Variance	Cum-ulative %
7	1.072	6.308	73.738	1.072	6.308	73.738	1.392	8.186	73.738
8	.816	4.801	78.539						
9	.700	4.117	82.656						
10	.619	3.639	86.294						
11	.542	3.185	89.480						
12	.493	2.900	92.380						
13	.416	2.445	94.824						
14	.307	1.806	96.630						
15	.230	1.352	97.983						
16	.199	1.173	99.155						
17	.144	.845	100.000						

Extraction Method: Principal Component Analysis.

The Total Variance Explained of table 9 above is 17 items describing factors influencing the risk perceptions of construction firms of construction projects. The other 7 factors provided by respondents were analysed differently from the main factors. The output shows that the first seven factors are accounted for by approximately 74%. This means that we have seven factor-structures of risk perceptions influencing construction project. The rotated component Matrix table 10, below summarises the structure of the component as against each factor loading.

Table 11:Rotated Component Matrix[a]

Factors	Component						
	1	2	3	4	5	6	7
Uniqueness of project	.144	.226	.344	-.068	.706	-.142	.173
Complexity of deliverable	.134	.098	-.015	-.065	.073	.107	.896
Financing	-.245	.192	.321	.011	-.751	.049	.032
Adequacy of funds	.202	.230	.215	.523	-.524	-.073	.237
Project location	.727	.088	-.348	.096	.000	-.046	.317
Project surroundings	.818	-.090	-.011	.045	.246	-.186	.069
Hazardous materials	.087	-.879	-.013	-.048	.046	.041	-.004
Definition of project	.594	.256	.031	-.138	.071	.285	-.369
Site availability	.550	-.259	.487	.100	-.084	.361	.038
Project justification	.021	-.083	.822	-.121	-.128	.191	-.130
Project approvals	-.227	.211	.718	.246	.074	-.045	.124

Factors	Component						
	1	2	3	4	5	6	7
Client experience	.053	-.123	-.149	.767	.044	.134	-.303
Client relationships	-.033	.083	.139	.883	-.094	.041	.109
Assessment of contractors	-.002	-.057	.085	.084	-.116	.865	.112
Procurement method	-.054	.406	.233	.128	.084	.432	-.224
Consultant selection	-.105	.515	-.007	-.015	.472	.438	.120
Stakeholder interest	.434	.647	-.016	-.058	-.068	-.023	.216

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 12 iterations.

The following items have substantial loadings on each factor as shown from the matrix, higher loadings corresponding to a project risk factor;

Factor 1: Project location and Project surroundings

Factor 2: Stakeholder interest

Factor 3: Project justification and project approval

Factor 4: Client Experience and Client relationship

Factor 5: Uniqueness of Project and Financing

Factor 6: Assessment of Contractors

Factor 7: Complexity of deliverable

CHAPTER FIVE

DISCUSSION OF THE CONCEPTUAL MODEL

5.1GENERAL

The main purpose of this study was to develop a simple but effective, user-friendly, risk perception model that will serve aid local construction organizations in their bidding decisions. The proposed model aims at providing the contractor with a quick, but accurate risk perception of proposed projects until such time as a more detailed risk analysis can be done.

The targeted users of this model therefore are local Ghanaian general construction firms, although it may possibly be adapted for use by other entities in the construction industry, such as consulting firms, subcontractors, and suppliers who also regularly face the bid/ no-bid decision.

5.2CONCEPT AND DEVELOPMENT

The model is basically in the form of a quantitative Microsoft Excel-based spreadsheet, derived from the conversion of the qualitative risk profile model (shown in Table 13 below) previously developed at Heriot-Watt University.(University, Heriot-Watt 2004)

Table 12: Concept and Development

	High	← Risk Rating →			Low
Factor	5	4	3	2	1
Uniqueness of Project	Prototype incorporating new techniques	Unusual project	Conventional project	Modifications to an existing design	One of a series of repetitions
Complexity of Deliverable	Outcome based contract (eg. PFI)	Coordination of services (e.g. FM)	Design and construct	Supply and Installation	Supply only
Financing	Private sector funding or joint venture	Capital works not yet approved or requested	Capital works in forward estimates	Capital works already allocated	Recurrent funds in current year
Adequacy of funds	Very likely to be inadequate	Likely to be adequate	Tight budget achievable with control	Adequate with some contingency	Adequate with generous contingency
Project location	Remote inaccessible	Remote accessible	Regional but distant	Regional	Metropolitan
Project surroundings	Activities in occupied areas	Staging within occupied areas	Additions to occupied areas	Well clear of occupied areas	Greenfield site
Hazardous materials	Working with hazardous materials	Possibly involves hazardous materials	Hazardous materials exist, but not part of works	Unlikely to encounter hazardous materials	No known hazardous materials
Definition of project	No project information available	Brief project description	Generic project brief available	Feasibility study completed	Detailed project brief available
Site availability	Site not identified	Several sites identified	Site identified but not yet purchased	New site purchased	Existing site
Project justification	Need has not been justified	Justification is questionable	Need justified but maychange through project	Need justified based on historical information	Need fully justified through recognized process
Project approvals	Unidentified approvals required	Potential approval delays have been identified	Required approvals are known and documented	Few approvals required or most btained	No approval required or already obtained

	High	← Risk Rating →			Low
Factor	5	4	3	2	1
Client' experience	Inexperienced multiple clients	Mixed experience amongst clients	Inexperienced single client	Experienced multiple clients	Experienced single client
Client relationships	Multiple reluctant clients or relationship not established	Mixed relationship with clients	Reluctant client or relationship not established	Good working relationship (multiple clients)	Good working relationship
Assessment of contractors	Unknown contractors	Limited number of unproven contractors	Limited number of competent contractors	Adequate number of competent contractors	Abundance of competent contractors
Procurement method	No tendering and involving sponsorship	Negotiated tender	Tendered outside agency	Public open tender	Selected tenderers
Consultant selection	Selection without approved processes	Design competition	Full EOI and RFP	Period panel consultant	Consultant selected using approved process
Stakeholder interest	High level of political, community or media sensitivity	High profile client or project	Stakeholder groups involved	Project may attract stakeholder or media interest	Project unlikely to attract stakeholder or media interest

Table 13: Risk Profile of a Project (Original Version)

The approach adopted for this conversion was to:

1. By research, establish the perceived relative importance of each listed risk factor, from the point of view of local Ghanaian construction experts.
2. Derive relative weightings for each factor, also based on research

3. Rank the list of seventeen (17) factors according to their relative weightings and reduce them to a maximum of eight (8), using tools like Relative Importance Index and Factor Analysis.

4. Incorporate three additional columns into the original model (See Tables 13 and 14) namely: Relative Weighting (Column B); Selected Risk Rating (Column H); Risk Perception Value (Column I).

Factor	Relative Weighting (B)	High 5	← Risk Rating → 4	3	2	Low 1	Selected Risk Rating (H)	Risk Perception Value (BX H)
Uniqueness of Project	12.4%	Prototype incorporating new techniques	Unusual project	Conventional project	Modifications to an existing design	One of a series of repetitions	1.00	0.0248
Complexity of Deliverable	11.8%	Outcome based contract (eg. PFI)	Coordination of services (e.g. FM)	Design and construct	Supply and Installation	Supply only	1.00	0.0236
Financing	13.9%	Private sector funding or joint venture	Capital works not yet approved or requested	Capital works in forward estimates	Capital works already allocated	Recurrent funds in current year	1.00	0.0278
Adequacy of funds	14.0%	Very likely to be inadequate	Likely to be adequate	Tight budget achievable with control	Adequate with some contingency	Adequate with generous contingency	1.00	0.028
Project location	11.5%	Remote inaccessible	Remote accessible	Regional but distant	Regional	Metropolitan	1.00	0.023
Definition of project	12.0%	No project information available	Brief project description	Generic project brief available	Feasibility study completed	Detailed project brief available	1.00	0.024
Procurement method	11.7%	No tendering and involving sponsorship	Negotiated tender	Tendered outside agency	Public open tender	Selected tenderers	1.00	0.0234
Stakeholder interest	12.8%	High level of political, community or media sensitivity	High profile client or project	Stakeholder groups involved	Project may attract stakeholder or media interest	Project unlikely to attract stakeholder or media interest	1.00	0.0256
	100%						TOTAL RISK PROFILE	0.2002

Table 13: Risk Profile of a Project

The 'Relative Weighting' (RW) column contains the respective relative factor weightings established by research (See Chapter 4), and which factors have been 'reduced' to eight (8) in numbers, from the original seventeen (17). In use, these relative factor weightings will be fixed and apply in the same magnitude to each project to which the model is applied. The cells in this column will therefore be 'locked' to prevent inadvertent changes by prospective model users. The sum of the relative weightings adds up to '1' or "100%" as would be expected.

The 'Selected Risk Rating' (SRR) column is an input column where users can input their selection of 'Risk Rating' classification for each risk factor regarding each specific project, guided by the respective Risk Rating Classification shown in preceding columns (columns 3 to5). A project perceived to have an extremely high risk rating on a particular factor would be scored a '5' in the SRR column, whereas that with an extremely low risk rating would score a '1' in the same column. For example, for a project, say A, if it is perceived by a model user as a ' prototype incorporating new techniques', would receive an SRR score of '5' against the risk factor 'Uniqueness of project', but if perceived by same user as 'one of a series of repetitions', would be assigned an SRR of '1' and so on.

It must be noted, however, that the notes under the 'Risk Rating' columns, as mentioned are just meant to serve as explanatory guides to the user, and in this researcher's opinion may be modified within each organizational setting to make the respective risk factor and its scenarios better understood by the user, and to make them more contextually applicable.

The 'Risk Perception Value' (RPV) column combines each factor's RW with the respective SRR using simple multiplication to give the "Risk Perception Value" (RPV), of the project in question, corresponding to each respective factor. The respective RPV's for each factor are located in the ninth (9^{th}) column of the spreadsheet and the formulae are input such that each RPV is calculated or re-calculated each time the respective SRR is modified.

For risk profiling a project using this model, the respective RPV for each factor is determined by the user filling out the SRR column. The total Risk Profile Score for the project is derived by summing up its individual RPV's. This summation is done by the formula in the twelfth row, ninth in the RPV column.

The SRR values are primarily defined as integers, especially for simplicity, but users or user organizations can determine their own conventions and add decimals if they so choose. According to the scale chosen hereby, the minimum achievable Risk Profile score for a project would be '0.2002' or approximately '0.20'. Table 14 below shows how this can occur, by assigning SRR's of "1" for all eight (8) risk factors. This depicts the lowest and "most desirable" Risk Profile score (for the risk-averse user) achievable under this proposed model. Conversely, the maximum achievable Risk Profile score for a project would be '1.001' or approximately '1.00'. Table 15 below shows how this can occur, by assigning SRR's of "5" for all eight (8) risk factors. This depicts the highest and "least desirable" Risk Profile score (for the risk-averse user) achievable using the proposed model.

Hence the scale of Risk Profile Scores presented by the proposed model ranges, approximately, from '0.20' to '1.00'. This range could form the basis for formulating potential users' policy project risk acceptability and project risk classifications to aid the bid/no-bid decision. For example, potential users of the model could have a policy stipulating the 'Maximum Acceptable Risk Profile Score' and hence reject all projects exceeding it in magnitude. In another instance, alternative and/ or mutually exclusive projects could be ranked and prioritized by their Risk Profile Scores. Risk Profile scores could also be used as a guide for assigning mark-ups in bidding for various projects.

Factor	Relative Weighting (B)	High ← Risk Rating → Low					Selected Risk Rating (H)	Risk Perception Value (BX H)
		5	4	3	2	1		
Uniqueness of Project	12.4%	Prototype incorporating new techniques	Unusual project	Conventional project	Modifications to an existing design	One of a series of repetitions	1.00	0.0248
Complexity of Deliverable	11.8%	Outcome based contract (eg. PFI)	Coordination of services (e.g. FM)	Design and construct	Supply and Installation	Supply only	1.00	0.0236
Financing	13.9%	Private sector funding or joint venture	Capital works not yet approved or requested	Capital works in forward estimates	Capital works already allocated	Recurrent funds in current year	1.00	0.0278
Adequacy of funds	14.0%	Very likely to be inadequate	Likely to be adequate	Tight budget achievable with control	Adequate with some contingency	Adequate with generous contingency	1.00	0.028
Project location	11.5%	Remote inaccessible	Remote accessible	Regional but distant	Regional	Metropolitan	1.00	0.023
Definition of project	12.0%	No project information available	Brief project description	Generic project brief available	Feasibility study completed	Detailed project brief available	1.00	0.024
Procurement method	11.7%	No tendering and involving sponsorship	Negotiated tender	Tendered outside agency	Public open tender	Selected tenderers	1.00	0.0234
Stakeholder interest	12.8%	High level of political, community or media sensitivity	High profile client or project	Stakeholder groups involved	Project may attract stakeholder or media interest	Project unlikely to attract stakeholder or media interest	1.00	0.0256
	100%						TOTAL RISK PROFILE	0.2002

Table 14: Risk Profile of a Project (Minimum)

	Relative Weighting (B)	High	← Risk Rating →			Low	Selected Risk Rating (H)	Risk Perception Value (BX H)
Factor		5	4	3	2	1		
Uniqueness of Project	12.4%	Prototype incorporating new techniques	Unusual project	Conventional project	Modifications to an existing design	One of a series of repetitions	5.00	0.124
Complexity of Deliverable	11.8%	Outcome based contract (eg. PFI)	Coordination of services (e.g. FM)	Design and construct	Supply and Installation	Supply only	5.00	0.118
Financing	13.9%	Private sector funding or joint venture	Capital works not yet approved or requested	Capital works in forward estimates	Capital works already allocated	Recurrent funds in current year	5.00	0.139
Adequacy of funds	14.0%	Very likely to be inadequate	Likely to be adequate	Tight budget achievable with control	Adequate with some contingency	Adequate with generous contingency	5.00	0.14
Project location	11.5%	Remote inaccessible	Remote accessible	Regional but distant	Regional	Metropolitan	5.00	0.115
Definition of project	12.0%	No project information available	Brief project description	Generic project brief available	Feasibility study completed	Detailed project brief available	5.00	0.12
Procurement method	11.7%	No tendering and involving sponsorship	Negotiated tender	Tendered outside agency	Public open tender	Selected tenderers	5.00	0.117
Stakeholder interest	12.8%	High level of political, community or media sensitivity	High profile client or project	Stakeholder groups involved	Project may attract stakeholder or media interest	Project unlikely to attract stakeholder or media interest	5.00	0.128
	100%						TOTAL RISK PROFILE	1.001

Table 15: Risk Profile of a Project (Maximum)

In order to make it attractive for targeted users, who generally have little time and motivation to engage in a lengthy formal risk analysis, the key desired attributes of the proposed model were: simplicity, user-friendliness, brevity, reliability, and accuracy.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1SUMMARY

The main purpose of this study was to develop a simple but effective, user-friendly, risk perception model that would aid local construction organizations to profile prospective construction projects and thereby better inform their bidding decisions. The proposed model aims at providing the contractor with a quick, but accurate risk perception of proposed projects, in lieu of, or until such time as, a more detailed risk analysis can be done.

The targeted users of this model therefore were local Ghanaian general construction firms, although it may possibly be adapted for use by other entities in the construction industry, such as consulting firms, subcontractors, and suppliers who also regularly face the bid/ no-bid decision. The summary of findings is as shown in the Table below:

Table 16: Summary of Findings

ITEM	OBJECTIVE	FINDINGS
A	Review existing literature to improve understanding of how project risk analysis techniques can be used to inform contractors' bid/no-bid decisions	This was achieved and is presented in Chapter 3 of this report
B	To survey expert opinion on project characteristics that influence contractors' risk perceptions of Ghanaian construction projects, using the Heriott Watt risk profile table (see Table….) as a starting point.	The survey was conducted and the results are presented and analyzed herein in Chapter 3 and Chapter 4 respectively
C	Develop and propose a simple risk perception model for Ghanaian construction projects based on the survey results	This was achieved and is presented in Chapter 5

6.2 OBSERVATIONS AND CONCLUSIONS

The following conclusions can be drawn on the premises of results of this research:

1. There was a general consensus among the surveyed Ghanaian construction professionals that some form of formal risk analysis was required to guide/inform the bid/ no-bid decisions of Ghanaian construction firms.

2. The perceived risk profile of a proposed construction project may help a contractor to say "yes" or "no" to an invitation to bid. It may also guide the level of mark-up a contractor may want to apply to his/her bid for a proposed project, and his/her prioritization of alternative "biddable" projects.

3. A plethora of factors influence the Ghanaian contractor's perceptions of the risk associated with any prospective construction project.

4. Each of the original list of seventeen risk factors (ref. Table 16) surveyed were determined to be relevant, but for the sake of brevity and simplicity, the Eight (8) strongest were included in the final model.

5. The survey respondents proposed other factors, such as "political influence" for strong consideration as risk factors in the Ghanaian setting, and which factors were not among the original list. It therefore suggests that, whereas there was a strong commonality between the risk factors from Heriot Watt University in Scotland, and those obtained in Ghana, there are some differences. Hence, factors influencing risk perception contractors can be said to differ from country to country, or context to context.

6.3 RECOMMENDATIONS

Based the foregoing research and discussions the following recommendations were deemed expedient:

1. Ghanaian contractors should be encouraged to incorporate simple formal risk analysis into the processes of making bid/ no- bid decisions.

2. The proposed risk profile model should be widely adopted, tested, and used by local construction firms to aid pre-bid decision making, and also to provide the necessary feedback, over time, for refining and improving the model.

3. The research process for the proposed model should be repeated and reviewed for improvement, and specifically to incorporate the additional factors proposed by the expert respondents of this original research.

APPENDIX 1

QUESTIONNAIRE FORMAT

INTRODUCTION

I am a student of The Kwame Nkrumah University of Science and Technology currently studying for an MSC degree in Construction Management in the Department of Building Technology. In partial fulfillment of my degree requirements I am currently undertaking a research into contractors' pre-bid risk indicators. The proposed research will form the basis for the development of a conceptual model for predicting the "riskiness" of a construction project in Ghana at the pre-bid stage.

The purpose of this questionnaire is to solicit the opinion and perspectives of construction experts with experience in construction pre-bid decision making. Each respondent will be required to provide a ranking and weighting to a set of factors considered to be indicators of project risk (as proposed by a group at the Heriot Watt University.). They would also be allowed to propose additional factors

Your contribution towards this survey is highly valued. Please be assured that any information you provide will be treated with strict confidence. Thank you in anticipation.

SECTION 1: GENERAL INFORMATION

1. What is your professional background?
   - Architect ( )
   - Consulting Quantity Surveyor ( )
   - Contractor's QuantitySurveyor ( )
   - Contractor /Project Manager ( )
   - Civil Engineer ( )
   - Other (Please Specify …………………) ( )

2. How many years of experience do you have working in the construction industry?
   - 0- 5 years ( )
   - 6-10 years ( )
   - 11- 15 years ( )
   - 15- 20 years ( )
   - 20- years ( )

3. Please indicate below the type of firm with which you work
    - Construction contracting firm ( )
    - Construction consulting firm ( )
    - Integrated Construction firm (e.g. Design and Build) ( )
    - Other (Please specify ……………………………………) ( )

4. Have you had any active role in the bidding decision process of a construction firm in Ghana?
    - Yes
    - No
5. From your experience do you consider formal risk analysis an important part of the Ghanaian contractor's decision to bid for a project?
    - Yes
    - **No**

SECTION 2

The attached spreadsheet shows a list of proposed project risk factors inspired by a similar table developed at the Heriot Watt University in Scotland. It forms a prototype that will be developed into a model that will facilitate pre-bid risk analysis of Ghanaian construction projects

6. Please critically review the listed factors and, in column A, add on any other factors that were not captured, but which, in your opinion, are important in determining the 'riskiness' of a constructionproject in Ghana.

7. In column B of the attached spreadsheet, please rank the listed factors in order of decreasing importance starting from 1through to the last.

8. In column C please assign relative weightings, with a scale of 1 thru 10, to each of the factors. A weighting of 1/ 10 suggests little importance and one of 10/ 10 suggests utmost importance.

9. The construction firm's risk perception of a project should be a key consideration in the firm's decision to bid, or not to bid, for the project.

    - Strongly agree
    - Agree

- Disagree
- Strongly disagree

10. The proposed project risk perception model will be a useful guide to Ghanaian construction firms, in the bidding decision process, as well as in defining overall risk policy.
    - Strongly agree
    - Agree
    - Disagree
    - Strongly disagree

	A	**B**	**C**	**D**	**E**	**F**	**G**	**H**
		Factor Importance Ranking	Factor Weighting (0 -10)	High Low		← Risk Rating →		
No.	Factor Description			**5**	**4**	**3**	**2**	**1**
1	Uniqueness of Project			Prototype incorporating new techniques	Unusual project	Conventional project	Modifications to an existing design	One of a series of repetitions
2	Complexity of Deliverable			Outcome based contract (eg. PFI)	Coordination of services (e.g. FM)	Design and construct	Supply and Installation	Supply only
3	Financing			Private sector funding or joint venture	Capital works not yet approved or requested	Capital works in forward estimates	Capital works already allocated	Recurrent funds in current year
4	Adequacy of funds			Very likely to be inadequate	Likely to be adequate	Tight budget achievable with control	Adequate with some contingency	Adequate with generous contingency

	A	B	C	D	E	F	G	H
		Factor Importance Ranking	Factor Weighting (0 -10)	High ← Risk Rating → Low				
No.	Factor Description			**5**	**4**	**3**	**2**	**1**
5	Project location			Remote inaccessible	Remote accessible	Regional but distant	Regional	Metropolitan
6	Project surroundings			Activities in occupied areas	Staging within occupied areas	Additions to occupied areas	Well clear of occupied areas	Greenfield site
7	Hazardous materials			Working with hazardous materials	Possibly involves hazardous materials	Hazardous materials exist, but not part of works	Unlikely to encounter hazardous materials	No known hazardous materials
8	Definition of project			No project information available	Brief project description	Generic project brief available	Feasibility study completed	Detailed project brief available
9	Site availability			Site not identified	Several sites identified	Site identified but not yet purchased	New site purchased	Existing site
10	Project justification			Need has not been justified	Justification is questionable	Need justified but may change through project	Need justified based on historical information	Need fully justified through recognized process

	A	B	C	D	E	F	G	H
		Factor Importance Ranking	Factor Weighting (0 -10)	High ← Risk Rating → Low				
No.	Factor Description			**5**	**4**	**3**	**2**	**1**
11	Project approvals			Unidentified approvals required	Potential approval delays have been identified	Required approvals are known and documented	Few approvals required or most obtained	No approval required or already obtained
12	Client' experience			Inexperienced multiple clients	Mixed experience amongst clients	Inexperienced single client	Experienced multiple clients	Experienced single client
13	Client relationships			Multiple reluctant clients or relationship not established	Mixed relationship with clients	Reluctant client or relationship not established	Good working relationship (multiple clients)	Good working relationship
14	Assessment of contractors			Unknown contractors	Limited no. of unproven contractors	Limited no. of competent contractors	Adequate no. of competent contractors	Abundance of competent contractors
15	Procurement method			No tendering and involving sponsorship	Negotiated tender	Tendered outside agency	Public open tender	Selected tenderers

	A	B	C	D	E	F	G	H
		Factor Importance Ranking	Factor Weighting (0 -10)	High Low		← Risk Rating →		
No.	Factor Description			**5**	**4**	**3**	**2**	**1**
16	Consultant selection			Selection without approved processes	Design competition	Full EOI and RFP	Period panel consultant	Consultant selected using approved process
17	Stakeholder interest			High level of political, community or media sensitivity	High profile client or project	Stakeholder groups involved	Project may attract stakeholder or media interest	Project unlikely to attract stakeholder or media interest

APPENDIX 2

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