EXPLORING CONSTRUCTION RISK FACTORS IN AN OPERATIONAL AIRPORT ENVIRONMENT: A CASE STUDY OF KOTOKA INTERNATIONAL AIRPORT

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DECLARATIONS

I hereby declare that this submission is my own work and that, to the best of my knowledge and behalf, it contains no material previously published or written by another person nor material which is to be substantial extent has been accepted for the award of any other degree or diploma at Kwame Nkrumah University of Science and Technology, Kumasi or any other educational institution except where due acknowledgement is made in the thesis.

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ABSTRACT

Construction risks is an essential factor during execution of construction projects because it affects the whole project delivery process predominantly production costs and execution time of projects. Construction risks that are continuously faced by airports are due to the highly dynamic environment exposed to these projects in an attempt to build or refurbish infrastructure to meet the demands of the environment. Kotoka International Airport currently stands as the only international airport in the country hence it experiences increased pressure on its infrastructure. This study sought to explore construction risk factors in an operational airport environment using Kotoka International Airport as case study. The study adopted a quantitative method and a case study approach as a research strategy. Questionnaires were used as data collection instrument to gather data from various construction companies that are undertaking construction activities at Kotoka International Airport. From the survey it was realized that the most occurring risks associated with construction projects in an operational airport environment such as Kotoka International Airport from the contractors were; Tight project schedule affected by long bureaucratic approval procedures within government agencies, Government agency identifying excessive project cost that results in loss of interest to fund construction project, Government restrictions on funding for certain airport maintenance projects, high Security and safety related issues causing delay in the construction process and affecting project cost, and changes in government funding for the fiscal year affecting project schedule. Respondents noted that the following risk factors had significant impact on their works which are Agricultural land owners not willing to sell land for airport development purposes, Local community opposition to airport capital development, Chosen airport location which does not fit with the purposed planning, development and operation of airport facility affecting overall development process, possible labour strike affecting construction process and land owners unwilling to sell identified land for airport development. Mitigating strategies to these impact are key to managing risk. Risk control, risk reduction, risk avoidance, risk sharing, risk retention, and risk transfer were identified as mitigation strategies to these factors. The knowledge of the existence on construction risk is not enough, contractors need to know its impact and how it is affecting the progress of the construction works including understanding and complying to all safety measures during execution of works at the Airport. Contractors undertaking works at Kotoka International Airport must undertake thorough risk assessment at the early stages of the project cycle to mitigate these risks. Furthermore, Airport managers and operators must frequently document risk on their construction projects. This would serve as an effective and efficient guidance document for contractors undertaking works at the Airport in the future.

Key words: construction risk, Airport construction, risk factors.

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CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF STUDY

The construction industry is a key industry in terms of impact and size. This industry is thought of not only as a single industry, but rather as an industry where varied market sectors assimilate to create the industry. Construction according to Alnasseri et al., (2013), plays an equally vital role in every economy of developing and developed countries in terms of economic growth. The airport as an industry is an enormous investment with a high level of impact on both the economic values and development of a region. As a result of the rapid technological developments in information technology, business and transportation, the aircraft industry continues to evolve (Eduful, 2009). Particularly, the air transportation sector continuously stimulates and promotes several industries to enlarging its markets and business which ultimately becomes a great benefit to the region. Factors like, cross border investment, increased communications, growth in population, international market operations, travel and tourism, have laid emphasis on the important role that airports play (Alnasseri et al., 2013). Kotoka International Airport currently stands as the only international airport in the country hence it experiences increased pressure on its infrastructure and limited service and resources. Ghana Airports Company Limited, the Kotoka International Airport Operator is aiming at meeting its organizational mandate of providing world class airport facilities and services for the benefit of their stakeholder (in text quote) since its establishment and this has necessitated the recent construction projects occurring at different scales predominantly at its international Airport.

Airport expansion projects have high construction risks (Zavadskas, et al, 2010). There are more challenges and difficulties in the form of risks with refurbishment, renovation and/or expansion and refurbishment projects, and are deemed the most common type of construction activity at the airport, in terms of the selection of materials, operation and facility systems that must be in line with the existing area (Alnasseri et al., 2013). These challenges contribute to the increased risks of airport construction projects. Risks are typical reasons for delays or cost overruns that can occur in a project (Akintoye and MacLeod, 1997). As airports typically operates 24hours, construction works can often only be executed when traffic and passenger capacity is low; normally during night working at inconvenient hours. Construction often requires the presence and movement of construction labour and equipment near critical airport traffic areas (Khalafallah, El-rayes and Asce, 2006).

Risks constitutes an essential factor for consideration since it can affect both the cost-benefit analysis during the whole process of a project, and the demand, production costs, execution time, and financial variable (de Palma et al., 2012). The construction of a totally new airport or the extension of an already existing one necessitates vast investments and many times private and public partnerships are considered in order to make such projects possible (Capitanul et al, 2014). A key characteristic of these projects is uncertainty in relation to the financial and environmental effects/impacts on the medium to long term. Additional one is the multistage nature of these types of projects. Many airport developments projects have been a success over the years, whiles others have not (Streck and Rossbach, 2013). The risks that are continuously faced by airports are due to the highly dynamic environment exposed to these airports. However, conducting this research to identify the construction risk, exploring and understanding the consequences and proposing mitigation measures to be used by stakeholders to address these risks are key to achieving an efficient construction system without interrupting airport operations.

1.2 PROBLEM STATEMENT

The construction industry is no exception in being exposed to uncertainties which are complex and diverse risks (Zhao et al., 2016). It was estimated by the National Aerospace Laboratory that, commercial airports worldwide experience risks ranging from $4,000,000,000 - $10, 000,000 (Balk, 2008). A large portion the cost from finance and associated time related obstacles from risk damage emanate from hierarchical leadership within the commercial aviation industry. Airport representatives (owners and/or project managers) and government agencies endure the effect of such damages on project-related objectives at most commercial airport facilities.

Many contractors are unfamiliar with these risk factors and do not have the experience and knowledge to manage them effectively (Laryea and Hughes, 2008) especially in an operating airport environment where construction works are to be undertaken. As a consequence, conflicts, poor quality, late completion, poor cost performance and business failures are commonplace in the construction industry.

There are some risk elements innate any time a construction project is embarked on. These are physical risk, legal risks and political risk among others (Perry and Hayes, 1985). Risks that are not dealt with adequately results in poor performance with increased costs and time delays (Thompson and Perry, 1992). Laryea and Hughes (2008) asserts that a research carried out in Ghana identified a trend that is being experienced by reporting that risks allowances made by contractors in their estimates seemed to be guided by concerns about competition and winning the job rather than the true cost of risk. Hence exploring risks in an operating airport environment during construction activities is needed for the successful delivery of the project without affecting the on-going activities of the airport.

The capacity to define risk in advance requires using risk management. Risk management practice, plans and cushions against risk in the aviation industry. Gabel et al (2010) posits that, the focus of risk management is to ensure that potential prospects that surrounds project scheme are taken due advantage of and that project objectives are met duly. It is the application of risk management values to airport construction related activities that will limit risk impact on construction project objectives.

1.3 AIM

To explore construction risk factors in an operational airport environment at Kotoka International Airport.

1.4 RESEARCH QUESTIONS

1. What is the construction related risks that occurs within an operational Airport environment?
2. What are the consequences of these risks on the construction projects in an operational airport?

1.5 OBJECTIVES

1. To assess construction risk factors which occurs within an operational environment being Kotoka International Airport.
2. To examine the consequences of these risks factors as operation are on-going in the Airport Environment
3. To propose mitigation strategy pertaining to risk related construction at Kotoka Internal Airport.

1.6 RESEARCH METHODS

Quantitative approach will be used during this research and the research strategy that will be used is a case study approach. Questionnaires will be used as the data collection instrument. Data will be taken from the various construction companies that are undertaking construction activities at the Kotoka International Airport. Purposive sampling techniques will be employed to select respondents for the study. The data gathered will be analyzed using SPSS to enable the interpretation of the data so as to generate findings and give recommendations.

1.7 RESEARCH SCOPE

The scope of this research is contextually the Kotoka International Airport and geographically Accra. This is because Accra has the biggest airport in the country. The study will mainly identify different construction related risk factors during airport operations. The risk identified and its consequences to the construction being done and airport operations would be determined. Mitigation measures would be proposed to address the consequences of the risk identified.

1.8 SIGNIFICANCE OF THE STUDY

This study is of great importance as it would provide information on the types of risks that can occur in an operational airport environment when construction activities are underway. By so doing, airport operators and construction workmen can therefore put in place measures to minimize the negative effects of these risks.

1.9 DELIMITATIONS OF THE STUDY/SCOPE OF THE STUDY

This study is limited to the Kotoka International Airport; hence, the findings of this research cannot be generalised to other airports in Ghana. However, the outcome of this research can inform stakeholders to pay critical attention to variations in the construction of airport projects so as not to affect the project success significantly.

1.10 ORGANISATION OF STUDY

The study has been organised into five chapters. The first chapter discusses the general background of the study. This includes the problem statement, research questions, aim, objectives, scope of study, a summarised version of the proposed methodology. The second chapter reviews literature relevant to the study. The third chapter discusses the research design methods that would be used to conduct this study. Chapter four will be used for presenting and discussions of the results. The final chapter will be used to represent the summary of findings, conclusions and the recommendation

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

The construction industry is one of the key industries in terms of having significant size and relevant impact. This industry is thought of not only as a single relevant industry, but rather as an industry where varied market sectors assimilate to create the industry. Among the diverse types of construction sectors and their copious types of construction works, construction projects at airports in particular are multifaceted, complex and are characterized uniquely. There are several important and diverse activities that are performed (whether within the terminal, airside or landside zones) in airport projects. Range of people, management processes, project stakeholders, techniques and tools compound activities at the airport and contribute to accomplishing construction works therein.

2.2 THE GHANAIAN CONSTRUCTION INDUSTRY

The construction industry massively contributes to the economic development and subsequent growth of developed and developing countries. Research reveals that the industry of construction displays that it contributes 5% to 10% of GDP (gross domestic product) in every country and it utilizes up to a 10% of the working population of a country and is subsequently responsible for around half of the gross fixed capital formation. The construction industry contributes about 6% to 10% of GDP and offers employment for 3.1% of the Ghanaian Labour Force (GSS, 2012) in Ghana.

Ghana like most developing country has a fragile construction industry with little to no standards and regulations for the development of infrastructure. The skills gap of many construction workers evident across the country in close to poor quality construction works,

workmanship, structural failures and preventable injuries and fires (Ahadzie and Amoa-Mensah, 2010). Ofori (2006) stipulates that, the construction industry in Ghana is confronted with myriad of technical, non-technical and peculiar project management issues and challenges. The non-technical challenges comprise lack of skills, know-hows and experience needed to deliver projects.

2.3 AIRPORT CONSTRUCTION PROJECTS

According to (Kapur, 1995), services like transport and infrastructure are the rudimentary ingredients for growth in the economy, production and a countries development. The aviation sector has been helping innumerable industries to increase their business and markets which ultimately benefits the region (Alnasseri et al., 2013).

Airport construction projects have been recognized as being some of the most complex (Nassim and Mahmoud, 2009). There are difficulties and challenges involved within the construction industry and the level of immersion is increased in the context of airport construction (Alnasseri et al., 2013). Some challenges that may be associated with the construction of airports are the time constraints which is fervently critical in projects in aviation with airport clients mostly concerned with the time of completion of the project. Airport design and construction is made up of special systems and specification and these makes airports more multifaceted and/or complex such as sophisticated devices for electrical, security and data systems, distinct firefighting and alarm systems and any additional level of the complexity to the design and construction process (Engineering News Record Magazine, 2013).

Risks are therefore typical in airport construction and these risks are the causes of delays or cost overruns that can occur in a project (Akintoye and Macleod, 1997). The airport industry is a huge investment industry with high level effect on the economic values and development

of a region (Alnasseri et al., 2013). This is characterized with difficulties and complexities that face an airport operator, responsible for operations management and development of infrastructure. Airports are gradually becoming a multinational transportation hub link with a lot of buildings within significant area where frequent refurbishment are required and/or expanded in order to meet the needs of community, growth and ever-changing needs of the industry (Binnekade et al., 2009). Difficulties and challenges are linked with the refurbishment and expansion projects, which are the basic type of airport construction activity in relation to the selection of materials, operating and facility systems that must be in line with the existing area (Alnasseri et al., 2013). Airport construction projects have countless stakeholders and all of whom have major input during the project life cycle. This is due to great number of activities characterized with passenger and aircraft flows (Fouris and Lock, 2009). Accordingly, the reaching of an agreement amongst the varied requirement and demands is not an upfront process. (Adrem et al., 2006) explains the process where several significant stakeholders within an airport construction project can drive varied construction requirements based on their functions; for instance, commercial, traffic coordination, terminal coordination, customs/security and design. The diverse functions and activities within airports impose the design outline and specification to be established and prepared by an airport operator/administrator prior to involvement of construction practitioners (Adrem et al., 2006).

2.4 RISKS IN CONSTRUCTION PROJECT

The construction industry is frequently characterized as a risky business to its strategic and complex nature. It involves varied project stakeholders, internal and external factors which lead to massive risks (Renuka et al., 2014). Unfortunately, the construction industry has poor reputation in risk analysis when compared to other industries (Laryea and Hughes, 2008).

Nevertheless, no construction project is totally risk free. However, risk can be managed, minimized, shared, transferred, or accepted. It cannot be ignored (Latham, 1994). Risk is a complex, multi-facet concept and according to PMI (2008), project risk management is the process concerned with identifying, analyzing and responding to project risk. According to Zhao et al. (2010), a construction project is plagued with various risk in all the stages of the life cycle of the project. Regardless of the project size, risk management should be emphasized in construction project (Hwang et al., 2013). Up until 2000, only a few attempts have been made on the identification and assessment of risk factors of the construction projects. As a result, there was a lack of systematic approaches to identify and manage the risks in construction projects (Chapman, 2001).

Risk is defined as the exposure to gain/loss, or the possibility of occurrence of gain/loss multiplied by its relevant magnitude. Events are said to be certain if the possibility of their occurrence is 100% or totally uncertain if the possibility of occurrence is 0%. Jaafari (2001) posits that, amid these extremes, the uncertainty differs widely. Risk can also be expressed as an event, characteristic of an action or situation, in which a varied number of outcomes are possible, at least one of the possibilities is not desirable and the particular one that will occur is uncertain (Yoe, 2000). Zayed and Chang (2002) further expressed risk in general as the presence of potential and/or actual constraints that could stand in the way of the performance of project, causing partial or complete failure either during construction or at time of use (Greene, 2001).

Certainty of risks exists only when one can specify exactly what will happen during the period covered by the decision. However, according to Flanagan and Norman (1993), this is uncommon in the construction industry. Education and Learning Wales (2001) stated that uncertainty and risk can be defined as follows:

- Risks occurs once a decision is stated in terms of range of possible outcomes and when known probabilities can be characterized to the outcomes
- Uncertainty occurs once there are more probable results of a course of action but the probability of each outcome is unknown.

The literature of Flanagan and Norman (1993) differentiates between risk and uncertainty. Risk gives itself to quantitative expression and has place in calculus of probability. Contrarily, uncertainty may be defined as a situation in which there is no historic data or prior history related to the situation being considered by the maker of decision.

Risk in the context of construction have been categorized in diverse ways. Tah et al. (2013) characterized project risks into internal and external risks and developed a fuzzy model. External risks are dominant in the external environment of projects such as those due to inflation, technology change, currency exchange rate fluctuations, major client induced changes, weather condition, politics, climate, and major accidents or natural disasters.

2.5 RISK MANAGEMENT

Risk management can be defined as the systematic process of identifying, analyzing and responding to the project risk. It has six steps namely planning, risk identification, qualitative risk analysis, risk response planning, risk monitoring and control (Dey, 2012; PMI, 2008). Risk is an essential factor for consideration and it can affect both the cost benefit analysis during the whole process of a project and the demand, production costs, execution time and financial variables (de Palma et al., 2012). Risk management as is a process, structure and/or culture that's geared towards the efficient and/or effective management of risk related problems which could pose an adverse threat on probable objectives and opportunities allied with a project (Gabel, 2010). According to Burtonshaw-Gunn (2009), the risk management

process occurs in three varied process, detects risk and its probable damages ensuing from identified risk. Approaches of risk apportionment takes a combination or any of risk transfer, retention, avoidance and reduction (Ribakoff, 1979; Perry, 1986; Flamagan, 1993; Raftery, 1994). In the literature of William and Heims (1989), risk retention was revealed to be the sole alternative where risk transfer of prevention is not possible, likelihood of occurrence is insignificant, likely financial loss is trivial, transfer is profligate and avoidance is detrimental. Total risk avoidance in construction is considered by many literatures as unfeasible as it has the tendency to cause a contractor submitting an excessively high bid for a project and lead to projects halting. Project managers also choose to transfer risks using professional indemnity and through the wordings of contract conditions with client and designers. Uher (1999) defined Risk management is a tool that drives at finding the sources of uncertainties and risk, defining their effect, and developing suitable management responses. Simmons (1998) also defined risk management as the sum of all proactive management-directed activities, within a program that is intended to acceptably accommodate the possibly failures in elements of the program.

The literature of Smith et al. (2006) delivers a full description of the management of risk concept and its practicality. Risk management cannot be used as a tool to forecast the future, since that is not possible. Cooper et al. (2005) defined that risk management process includes the methodical application of policies of management, procedures and processes to the responsibility of launching the context, finding (identification), examining (analyzing), evaluating (analysis), treating, checking and communicating risks. It involves the core phases: Identification, assessment and analysis and response (Smith et al., 2006).

2.5.1 Benefits of Risk Management

In a bid to increase the efficiency of risk management, there is a need for the risk management process to be continuously enhanced during the full project. Consequently, risks would therein be revealed and managed through the entire phases (Smith et al., 2006). The focal motivations are clear awareness and understanding of the probable risks in the project therein. Risk management gives a better view of probable consequences ensuing from unmanaged risk and total elusion (Thomas, 2009).

2.6RISK IDENTIFICATION

The initial stage of risk management is the identification and it involves netting all potential risks. It the most accepted of all the risk management stages. It has the principal influence on the exactitude of any risk assessment (Chapman, 1998). In order to enable the proper identification of risk, it can be classified broadly as uncontrollable and controllable risks (Flanagan and Norman, 1993). Additionally, controllable risks are the risks that a decision maker assumes willingly and whose result evolves within his direct control; whilst uncontrollable risks as the ones which can influence (Chege and Rwelamila, 2000). The identification of risk entails identifying which risks are more probable to distress the project and recording the features of each. The identification of risk involves a technique used to generate risks, and guidance on what those risks should look like when written down (Isaac, 1995). According to Enhassi and Meyer (2009) a failure to identify the presence of possible risks may end in disaster or forgoing an chance of gaining from proper corrective action. Winch (2002) claims that the first step in the risk management process is usually informal and can be performed in various ways, depending on the organization and the project team.

2.6.1 Brainstorming

Brainstorming according to (Smith, 1999), is a significant and an open discussion whereby members discuss their opinions on probable bases of risk in a project and/or how uncertainty is displayed and how to flip it into risk, on possible risk responses on risk probability and on potential risk impact. The risk or project manager frequently presides over the discussion and its success enormously depends on his/her experience in piloting discussions of its nature. The technique is proficient and mostly ends in an all-inclusive risk list. An issue may emanate from the involvement of a very strict and officious personality who controls and enforces his/her stands. The number of partakers is vital because discussions with a huge number of members is also significant because discussions with a greater number of members becomes long-lasting inefficient.

2.6.2 Interviews

The interview techniques in which respondent answers arranged questions and discusses the issues involved therein (Carter et al., 1994). The aim of the interview is to register answers to questions, and use them subsequently as a foundation for the analysis. The questions can therein be unstructured, easily formulated, letting the respondent to answer them as wanted. Structured questions necessitate a yes/no answer from respondents or that it accepts one of numerous options offered.

2.6.3 Questionnaires

According to Godfry et al, (1996), questionnaires are certainly the fastest and most well-organized way of learning the opinion of the project team affiliates and permit these opinions to be examined and compared. These questions may or may not be unstructured or structured.

2.6.4 The Delphi technique

The Delphi method attempts to get unbiased results form a independent discussion (Powel, 1996). The risk or project manager begins by tendering out questionnaires to project team members, who in turn answer the questions and return the questions and the questionnaire to the risk manager. The risk or project manager hands out the answers to all the project team, who in turn use them to reexamine their method, give novel answers to the same questions and return it to the risk or project manager. According to Ceric, (2003), the reviewed results are then dispersed to the team, who are again asked to reassess their stands and give new answers. This iterative process stays until the risk or project manager decides that the agreement has been attained and that there is no more need to examine the stands of all the team member.

2.6.5 Expert Systems

Expert systems are developed with the help of knowledge on previous projects and the experiences of all the team members gathered therein to recognize probable risks (Carter et al., 1994). The expert system does not uncover all the unseen risks, but rather incorporate the entire experience from previous projects.

2.7 RISK ANALYSIS

Analysis of risk or risk analysis as a risk management process, deals with the bases and effects of events which tend to cause harm or rallies opportunity. The purpose behind such analysis and/or examination is an exact and impartial calculation of risk. Risk analysis includes evaluating the identified risks. It initially requires that the risks are quantified in terms of their effect on cost, time or revenue. They can be analyzed by measuring their effects on the economic parameters of the project or process. The analysis of risks can be quantitative or qualitative in nature depending on the amount of information available (APM,

2000). Qualitative analysis focuses on the identification together with assessment of risks and quantitative analysis focuses on the evaluation of risk (Chapman, 2001).

Qualitative analysis involves the identification of hierarchy of risks, their scope, factors that cause them to occur and potential dependencies (Lowe, 2002). According to Kuisment et al. (2002), the management of risk acts as a way to record the characteristics of each risk in qualitative risk analysis. Qualitative risk analysis assesses the importance of the identified risks and develops prioritized lists of these risks to further analysis or direct mitigation. Quantitative risk analysis is a way of numerically estimating the probability that a project will meet its cost and time objectives. Quantitative risk analysis considers the range of possible values for key variables, and the probability with which they may occur. According to (Abu Rizk, 2002), it involves allocating likelihoods and/or chances to the varied elements and a value for the effect then identifying therein the intensity for each element.

2.7.1 Simple Assessment

It can be expressed as a comparatively simple arithmetic technique that addresses important risks distinctly and evaluates the possible total effect (Powell, 1996). The assessment is grounded on calculating the likely impact of very substantial risk. The effects and/or impacts are subsequently added and the sum is used as the basis for the alternative plan. This method is suitable for simple and minor projects.

2.7.2 Probabilistic Analysis

Probabilistic analysis is an arithmetical technique that allows computing the exposure for individual risk and the entire project (Powell, 1996). Initial optimistic, most likely and negative cost and time approximations are given therein for each event. The probabilistic analysis is comprehensible and easy to adopt, but independent assessment makes it dependent so much on knowledge and experience of the project and/or risk manager who takes it.

2.7.3 Sensitivity Analysis

Flanagan and Norman (1993) asserts that sensitivity analysis shows the impact of every separate risk which is the unwanted effect of an event on the project. All the parameters that influence the exposure value are varied and how their changes affect the final result is followed. The percentage of parameter change is divided by the percentage of result change caused by that parameter change is called the sensitivity factor.

2.7.4 Decision Trees

Godfrey, (1996) reveals that decisions are made when there are varied options and/or alternatives. Each option and/or alternative consist of sub-alternatives which further comprises of sub-alternative which subsequently come together to form a tree structure presenting all the probable paths of decision making. If the effect and/or impact of every single alternative on the tree structure can be considered and its probability assessed, instinctively or in some other varied way, this will result in exposure (in Expected Value (EV)) which consequently define the level of risk of each alternative.

2.7.5 Monte Carlo Simulation

Wall, (1997) identified Monte Carlo Simulation as a statistical simulation technique. In that, each parameter that affects a specific exposure of risk is handled as a random variable with the probability distribution function and a conforming value rank. This function is hence derived from prevailing databases or assessed from experiences.

2.8 RISKS RESPONSE

Education and Learning Wales, (2001) identified general types of response to risk;

- Risk avoidance or reduction
- Risk transfer
- Risk retention
- Risk Sharing

2.8.1 Risk Avoidance

From the literature of Potts, (2008), it is revealed that there exist many potential risks that a project can be opened to which has the tendency to influence its success. Risk evasion and/or avoidance is expressed as the elimination of risk. Risk evasion and/or avoidance in the industry of construction is commonly recognized to be unrealizable as it has the tendency to lead to projects not moving ahead; a contractor inability to place a bid or an owner not continuing with project funding are varied examples of eliminating the risk totally. According to Flanagan and Norman, (1993), there are numerous ways through which risks can be explicitly eluded; for example, tendering a high bid; placing conditions on bid; pre-contract negotiations to ascertain who takes what risk; and not biding on high risk portion of the contract. Darnall and Preston (2010) suggest adopting already known well developed strategies rather than opting for recent ones even if it appears more cost efficient in instances where major changes are requisite in the project in order to elude risks,

2.8.2 Risk Transfer

This is basically eluding risk by transferring it to another party. It is advisable to transfer risk to the party that is more capacitated and/or capable of managing risk. Potts (2008) summarize it by saying that the risk should be moved or transferred to the party that knows how to manage it. An insurance premium would not relive all risks for a construction project,

although it gives some form of benefits as potential loss is covered by fixed costs (Tummala and Burchett, 1999). Therein, risk transfer can be categorized into two (2) distinct forms:

- By hiring a subcontractor or working on a hazardous process, the activity or property responsible for the risk maybe transferred.
- The activity or property can be retained, but the transfer of financial risk is by methods such as insurance and surety.

2.8.3 Risk Retention

Retention of risk according to Zhi, (1995), is a method adopted by internal management in decreasing controlling risks; handling risks by the party undertaking the project where total risk avoidance is not possible, possible financial loss is small, likelihood of occurrence is insignificant and transfer is improvident (Akintoye and MacLeod, 1997). The risks, (foreseen or unforeseen) are financed and controlled by the party or contractor or company. In all, there exist two varied retention methods thus, passive and active.

2.8.4 Risk Reduction

Risk Reduction is common term adopted for reducing the consequences and likelihood of an adverse risk event. In extreme cases, this may lead to the total elimination, as seen in risk evasion and/or. Nonetheless, reduction is not seen as efficient to cogitate only the resultant expected value, because the risk remains unacceptable if its potential effect is above a certain threshold and/or level. In a case like this according to Piney, (2002), one of the other approaches will have to be espoused. It is easy to detect problems which are causing damage by having an overview over the entire project. The exposed areas should be changed in order to reduce the risk threshold or level (Potts, 2008). This is an acceptable way of minimize the potential risks by mitigating their possibility (Thomas, 2009). One distinct way of decreasing risks in a particular project is to add expenditures that have the tendency to provide long term

benefits. Certain projects hire experts to manage high-risk projects and/or activities or capitalize in guarantees. According to Darnall and Preston, (2010), the experts may resultantly find solutions that may not have been considered by the project team. Cooper at al. (2005) posits that, mitigation strategies may consist of: quality assurance, contingency planning, separation or relocation of activities and resources, contract terms and conditions and crisis management and disaster recovery plans.

2.8.5 Risk Sharing

According to Barnes (1999), when a project participant can share risk with other participants when it's difficult to control risk exposure. Portion of the risk can be transferred but portions should be assumed and one of the responses to risk be consequently applied.

2.9 RISK FOR AIRPORT PROJECT DEVELOPMENT

Risk in project development as revealed by Nielson (2007), is the element, or factor that arises during the execution of project and accountable for the impeding achievements related therein with project cost, goals and schedule. These elements and factors can be internally and/or externally driven with bad consequences disturbing functionality, time of delivery, performance cost and acceptance (Burton Shaw-Gunn, 2009). According to Buronshaw-Gun, (2009), risks is expressed with variables that can be defined and can be negatively affected for airport capital and maintenance projects. Rakich (2011) categorized airport projects into regulatory risks, project-level risks and airport-level risks.

2.9.1 Project Level risk

This mainly occurs in the construction of facilities for airport and/or its component parts preceding operation of facility. This according to Ehiemere, (2013), happens during the various phases of the airport planning and project development till the construction is

complete. In terms of the construction phase activities of airport projects, schedule growth control of risks ensue when the schedule for construction changes, thus creating unanticipated issues that affect originally set construction phase objectives. Associated risks therein with the early precision of costs around inconsistencies in cost during project developments that distress schedule and project cost estimates. Unexpected cost of project that manifest with the project budget may result in the increase in ensuing funding required for project development (Touran, 2009).

2.9.2 Airport Level Risks

Airport Level Risk are associated with the issues on control whereby the staff and airport management are faced with regards to the facility at airport, agreement of third-party and security (Ehiemere, 2013). Problems associated therein with airport level risk comprise the staff's capability risk and airport management's experience. According to Rakich, (2011), these risk curtail from management and staff incompetency to manage and/or handle the administrative activities related with the airport facility. Risks involving activities related to construction and design quality during the operation phase of airport, by airport administration are defined as airport control of project risk (Rakich, 2011).

2.9.3 Public Policy-Regulatory issues

There exist legal mandates that are required to be followed regarding airport project delivery. It ranges from complying with policies, to social programs and labor unions etc. Following these mandates is important for the suitable operation and completion of airports. According to Touran, (2009), there are risks that arises within the context of these legal mandates that can influence and/or affect the total airport development objectives. (Ehiemere, 2013) stipulates that problems may occur from favoritism and competition of certain local talent

airport development especially when legal mandates necessitate that competition, bid pricing and project delivery methods for airport project development to be conducted a distinct way

2.10 COMMON RISKS FACED BY CONTRACTORS AND THEIR CONSEQUENCES

2.10.1 Construction Costs

Nworuh and Nwachukwu (2014) placed the responsibility of an adequate and proper evaluation of these risk on both the client and design advisers. Construction cost is conceived in this study as either initial contract sum or tender sum or as actual construction cost or the final account sum. According to Odeyinka (1999) initial contract sum comprises of site labour, cost, material cost and contractor cost, plant and establishments charges. Also, the initial and final contract sum are never the same due to inherent risk factor such as fluctuation, variation, re-measurement of provisional quantities, adjustment of provisional and prime cost and some other risk factors.

2.10.2 Inadequate Scope

Lack of scope definition causes serious problems on construction projects and can lead to numerous risks that can affect the project negatively (Construction Industry Institute, 2014).

2.10.3 Payment Delays

This is a risk caused by the client, and is as result of difficulties with client cash flow. Memon et al. (2011) asserts that prolonged delays in payment has consequences such as high risk of industrial disputes, wanton destruction of property, and high turn-over of workers. Delays in any form is regarded as construction risks as Faridi and El-Sayegh (2006) revealed that 50% of the UAE construction projects experience delays.

2.10.4 Design Changes

Literature reveals that there exist varied reasons why changes in designs occur. Some of which includes but not limited to variations of requirements by the client or variations in the site condition and faults in design documents (Sambasivan, 2007). Most designs are often inadequate and poorly articulated to even enable contractors to clearly understand what to build without several meetings with designers. Drawings do not often have sufficient details and right from the beginning, the client requirements are not captured in the tender documents and as a result leads to variations in the construction phase which is a risk to the cashflow, workflow and duration/programme (Laryea et al., 2008).

2.10.5 Insufficient and incompetent Personnel

There is a risk of lack of qualified construction professional with basic knowledge in construction works and this can impact the quality of construction projects. There is also a problem of supervision and managerial aspects of construction work in Ghana and that many workmen lack the necessary training for carrying out their work programme (Laryea et al., 2008).

2.10.6 Lack of Adaptation to Modern Methods of Construction by staff

Ohemeng-Ababio, et al., (2014) highlighted that, the country's construction industry process entails the usual strategies and consequently makes it surely difficult in the adaptation to cutting-edge strategies of the construction. The usage of modern machines and equipment, metals and reinforced concrete has become very popular discouraging alternatives. Furthermore, Illiteracy and the inoculation rate will be affected by various environmental factors besides government effectiveness (Treisman, 2000). Inadequacy of training contents to the unique desires of rural education. Now the initial and continuous training is almost exclusively focused on urban education model that addresses a child without problems

adapting to the school environment, arising from cultural deficit (Biriescua & Babaitaa, 2013).

2.10.7 High Cost of purchasing Technology and construction equipment

Omane (2016) highlighted that, most people in developing countries which Ghana is included prefer the old system of construction and therefore find it difficult in trying to innovative procedures, methods and techniques. Purchasing technology for construction is high. Due to this people hire rather than purchasing and may cause delays and inconvenience. Technological dependency is one of the major limitations to construction and however concluded that there is existence of some psychological problems of people looking down on local building technologies that are much more sustainable than foreign products that are not sustainable in this system. Technology could be important because it supports and attains construction by saving energy, time and by efficient use of resources. However, the high cost of purchasing technology and expenses needed to train staff may be considered as a risk to the construction projects (Osaily et al, 2010), due to the technical specifications required in Airport construction activities.

2.10.8 Supplier-Contractor Partnering

The winning contractor always divide the project into multiple subcontracts, this is because the main contractor does not possess certain skills and expertise (Mirawati et al., 2015). About 85% of construction tasks are executed by the subcontractors, thus the performance of subcontractors determines the success or failure of any project (Hinze and Tracey, 2015; Mbachu, 2008). According to Sambasivian and Soon (6), a high degree of subcontracting often leads to a high risk of time overruns and causes inefficiencies to the local construction industry.

2.10.9 Nature of the Work

Unlike any other construction projects, airport construction projects have a lot of technical and security issues that poses as risk especially if the airport is in operation and some construction activities have to be undertaken.

2.10.10 Safety Issues

There is also the risk of safety issues in airport construction where the construction workers would have to think and secure which is above the normal safety measures taking into consideration the working environment so as to protect the workers in the airport and also the workers working on the construction project.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter describes the background and reasoning behind the chosen research methodology. It also discusses the various steps undertaken in achieving the objectives of the study. This chapter also includes the choice of research, techniques and methods used and data collection, analyses and interpretations

3.2 RESEARCH DESIGN

Research design can be defined as a reasonable threshold of information essential to deliver the resulting answers to the research questions in each study. It also shows the collection and examination of data (Creswell, 2009). Research design as posited by Burns and Grove (2003), is an outline for piloting a research. There are three distinct types of research design thus, Exploratory, Descriptive, and Explanatory. Aggarwal (2008) define descriptive research as the collecting of data about predominant situations or conditions for the purpose of interpretations and descriptions. Descriptive research analysis is not the gathering and tabulating of facts but comprises of proper analysis, identifying trends and relationships comparisons and interpretation. Exploratory research design is exploring the questions of the research and does not anticipate offering concluding and decisive clarifications to problems that exist. In conducting exploratory research, the direction of the researcher can change due to certain new insights or data, thus the researcher ought to be willing to change when the direction or focus changes. Nargundkar (2003) asserts that exploratory research can be used to influence decisions on how to conduct subsequent studies. Explanatory research design deals with the clarification of the existence of a relationship that exist between two or more

aspects of a phenomenon or situation. The research design chosen for this study is descriptive research design.

3.3 RESEARCH METHODS

According to Creswell, (2005) a researcher in qualitative research turns into the instrument for collecting data. Data is gathered as the researcher cumulates the words of respondents by finding common subjects by concentrating on the connotation of the respondents, and subsequently describing a process using persuasive and expressive language. Creswell (2005) again outlines qualitative study as a kind of educational research whereby the researcher in the study relies solely on the view of respondents, extensive questions, amasses data consisting primarily of texts from respondents, describes and examines the texts from themes and conducts the inquiry in an independent and partial manner. According to Soiferman (2010), Qualitative research is a laborious approach to finding answers to questions that comprises an extensive length of time in the field, working in the habitually complex, time intense process of data analysis, writing lengthy passages and sharing in a form of human and social science research that does not have firm strategies or specific measures.

Researchers are expected to separate themselves from the participants in quantitative research. Quantitative research is supposed to be a value-free research (Onwuegbuzie and Leech, 2005). According to Soiferman (2010) quantitative research often translates into the use of statistical analysis to create the connection between what is known and/or what can be learnt through research. The gathering and analysis of data therein using quantitative approaches necessitates an understanding of the relationships among diverse variables using either inferential or descriptive statistics. It was asserted in the literature of Trochim (2006) that, descriptive statistics are adopted to draw inferences on the study populations and approximating the parameters of those study populations. The analysis of data includes

tackling each of the set hypothesis and questions independently. Creswell (2005)'s literature highlights two distinct statistical analysis which are inferential and descriptive. Descriptive statistics show principal tendencies in the data which are the mode, mean and median, the spread of score which are standard deviation, range and variance or a comparison of how one score relates the other (percentile rank, z-scores). The second types of statistical analysis depend on the use of inferential statistics. This types of analysis allows the research to compare the effect of independent variables on one or more groups by analyzing changes in the dependent variable (Creswell, 2005). Hence this research will adopt the quantitative research methods.

3.4 RESEARCH STRATEGY

According to Yin (2003), in selecting a particular research strategy, it must be guided by the research questions. According to Remenyi et al. (2003), research strategy provides the general direction of research along with the process by which the research is conducted. Fellows and Liu (2008) identifies case study, experiment, survey, action research, grounded, ethnography and archival research as examples of research strategies. Zikmund and Babin (2010) defines survey research as the use of structured instrument in gathering data from respondents. Lewis and Thornhill (2007) indicates that research survey are associated with deductive logic and are a consistent method of gathering information in research management by employing a questionnaire that gathers data from a sample then analyses the data statistically. Collins and Hussey (2009) defines case study as a research style used in exploring a single phenomenon in a natural setting using diverse methods to acquire in-depth knowledge. According to Denscombe (2007), case studies, places emphasis on a particular phenomenon with the ultimate goal of providing an in-depth account of events, experiences or processes that occurs in a particular instance. Experiment as defined by Denscombe

(2007), is undertaking a search to observe the characteristics of a relationship amid specific elements within controlled conditions.

This research will adopt case study as a research strategy using the multiple case study approach. The rationale for using multiple case study is to establish whether the findings of the first case occur in other cases. Multiple case study approach is mostly used for comparative studies in research.

3.5 RESEARCH INSTRUMENT

It refers to the tools used for the gathering of data during a study. A range of data collection tools include questionnaire, interviews, and the combination of these. The questionnaire was used for this study. The questionnaires will be devised to deal with the aim, objective and research questions of the research (Oppenheim, 2000). A good questionnaire is made up of questions which generate varying kinds of information from the respondents (Gall *et al*., 2003). According to Wilkinson and Birmingham (2003), the questionnaire is the convenient tool because of its ability to provide cheap and effective data collection in a manner that is structured and manageable. The questions posed may be structured or unstructured. Structured questions provide answers from which the respondents are asked to select answers from the provided options whiles, unstructured questions allow the respondents to provide their responses in their own words.

3.6 TARGET POPULATION

The target population is construction companies undertaking construction projects at Kotoka International Airport specifically the engineers, project managers, quantity surveyors in these construction companies.

3.7 SAMPLING TECHNIQUE AND SAMPLE SIZE

Sample is obtained from the population. The term 'sample' implies a component of a total (population) chosen to represent the rest (Naoum, 1998). A sample comprises of elements which make up the population (Polit and Hungler, 1999). Using a sample is much practical and less expensive as compared to retrieving data from the total population. The sampling technique for this study with inference to the research topic, aim and objectives, is purposive sampling. This is because the researcher choose what needs to be identified and undertakes to locate respondents (construction companies) who are undertaking construction projects at the Kotoka International Airport, Accra. The researcher also choses what needs to be identified and locate respondents who are willing to release the information by merit of experience or knowledge (Bernard, 2002; Lewis and Sheppard, 2006). In the context of this research, the purposive sampling approach involves identifying the contractors that are involved in construction activities at the Kotoka International Airport. Purposive sampling indicated the approaches where the researcher attached discretion as to who will provide answers regarding field of study and then purposely requests those definite viewpoints into the study. Purposive sampling according to Tong (2007), is beneficial for instances where one needs to contact a targeted sample. Snowball sampling will be adopted in gathering the sample size due to challenge in assessing the size of population. Atkinson and Flint (2001) defines snowballing as a procedure for locating research subject.

3.8 CASE DESCRIPTION

Kotoka International Airport was initially an airport for military used by British Air Force in 1946 during the World War II. The facility was handed down to civilian authority after a fruitful pull-out by the then military. In reply to globalization and the growing demand for air transport during the time, a advancement in project was launched in 1956 to reconfigure the

structure into terminal building. The conclusion of the project in 1958 set the platform for the Ghana Airways to use the airport as its base. The airport was formerly planned and commissioned to lodge a maximum of five hundred thousand (500, 000) passengers annually. Hence, in 1969, the Accra International Airport was renamed the Kotoka International Airport in loving memory of the late Lt. General E. K. Kotoka. The airport has since beheld important enhancements in facilities and infrastructure to meet the increasing demand. The Kotoka International Airport is the country's only international airport that handles all of Ghana's international flights. As at 2010, the Airport alone was handling over 800,000 passengers and 50,000 tons of freight annually (Ghana Civil Aviation Authority MIS Report, 2010).

3.9 DATA ANALYSIS

For the purpose of answering research questions and meeting the research objectives, quantitative data will be used for the analysis. Quantitative data refers to coded responses from the respondents in the form of numbers that are processed and analyzed for interpretation and discussion. These data will be processed to make them useful to be interpreted to obtain information. Quantitative data can either be primary or secondary type. The primary data refers to new data collected specifically for a particular purpose, mostly in relation to the objectives of the research. Secondary data implies data which has already been generated for other purpose but taken again and used for a varied reason from the original.

CHAPTER FOUR

ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

This chapter is dedicated to the analysis of the data obtained from the field. The first section describes the data obtained from respondents that gives integrity to the study. This chapter also demonstrates the results from every section of the survey instrument. This results from the analysis were discussed systematically in the study by the researcher.

4.2 DEMOGRAPHIC BACKGROUND OF RESPONDENTS

The reliability of any research is partly dependent on the source of data and the rigorousness of the analysis employed. In order to provide reliability and have confidence form the findings, questions were posed in the questionnaire that aimed at gathering information on the respondents. As shown in the table below, these respondents had worked on some projects at the Kotoka International Airport, therefore, they can answer questions pertaining to the type of risk they have encountered, the degree of its impact and some of the strategies that they often used in managing those risks.

Table 4.1: Background Information on respondents

Background Information	Frequency	Percentage
Highest Level of Education		
HND	7	17
BSc	26	63
MSc	5	12
PhD		
MPhil	2	5
BA	1	2
Years of experience		
Less than 4 years	11	27
4-8 years	8	20
8-12 years	13	32
12-16 years	3	7
Above 16 years	6	15
Contractor's Classification		
D1K1	16	39
D2K2	9	22
D3K3	20	20
D4K4	5	5
A1B1	15	15
A2B2	0	0
A3B3	0	0
A4B4	0	0
Number of Projects executed at Kotoka International Airport		
Less than 4 projects	28	68
4-8 projects	12	29
8-12 projects	0	0
12-16 projects	0	0
Above 16 projects	1	3

Source: Field Data (2019)

4.3 CONSTRUCTION RELATED RISK FACTORS WHICH OCCURS WITHIN AN OPERATIONAL AIRPORT ENVIRONMENT

From the table 2, it can be seen that *tight project schedule affected by long bureaucratic approval procedures within governmental agencies* was ranked first with a mean of 3.73. Respondents deemed this a construction related risk factor which can affect the success of a project. Another construction related risk in an operational airport environment was *Government agency identifying excessive project cost that results in loss of interest to fund*

construction project, this was ranked 2nd with a mean of 3.71. The Kotoka International Airport (KIA) has government as a stakeholder and the designated ministry which is the Aviation Ministry oversees activities at KIA. The Aviation Ministry as a governmental agency is mandated to approve or disapprove construction project to be undertaken by K.IA.

Government limitations on funding for some airport maintenance projects with a mean of 3.71 was ranked 3rd. Both the second ranked and third ranked factors had equal means hence the standard deviation was used for ranking. Standard deviations on a statistical data imply the measure of variability and consistency linked with interpreting the variables by respondents (Field, 2009). Standard deviation is deemed critical concerning statistical reliability and credibility of data (Motulsky, 2003; Field, 2009). Standard deviations lower than 1.0 linked with the mean values being measured imply high consistency and low variability between respondents in interpreting the variables (Motulsky, 2003; Field, 2009), whereas, standard deviation above 1.0 imply low consistency and high variability between respondents in interpreting variables.

High Security and safety related issues causing delay in the construction process and affecting project cost was ranked 4th with a mean of 3.68. At the Kotoka International Airport, security checks are conducted by detailed security agency in the country along with badges and licenses for all drivers, workers and vehicles are conducted (Adrem et al., 2006). Security in airport needs to be consistently high (Alnasseri et al., 2013). Also because it is an operational airport, critical safety measure must be put in place to avoid interrupting the operations of K.I.A as well as to reduce or mitigate the likelihood of any construction activity which has the potential to cause harm either in the form of incident or accident to passengers or users of the airport facility. *Changes in government funding for the fiscal year affecting the*

schedule project ranked 5th with a mean of 3.66. *Delay in acquiring licences and extra data essential to carry out construction project associated with infrastructural developments* was ranked 6th with a mean 3.66. The 5th and 6th factors all have the same means hence; the standard deviation was used to rank these factors. *Construction activity interference with airport operational activities* was ranked 7th with a mean of 3.63. *Occurrence of disputes between parties involved in the project over parameters that determine project completion* was ranked 8th with a mean of 3.56. *Unresolved constructability issues with design that could affect project objectives in the construction phase of airport development* was ranked 9th with a mean of 3.54. *Financial discrepancies in terms of funding and project cost due to misinterpretation of project size* was ranked 10th with a mean of 3.51.

Table 4.2: Construction related risk factors

Construction risk Factors	**N**	**Mean**	**Standard Deviation**	**Ranking**
Tight project schedule affected by long bureaucratic approval procedures within government agencies	41	3.73	1.096	1
Government agency identifying excessive project cost that results in loss of interest to fund construction project.	41	3.71	.814	2
Government restrictions on funding for certain airport maintenance projects	41	3.71	.929	3
High Security and safety related issues causing delay in the construction process and affecting project cost	41	3.68	1.105	4
Changes in government funding for the fiscal year affecting project schedule	41	3.66	.938	5
Delay in acquiring permits and additional information required to carry out construction project associated with infrastructural development	41	3.66	1.132	6

Construction activities interference with airport operation activities	41	3.63	1.157	7
Occurrence of disputes between parties involved in the project over parameters that determine project completion	41	3.56	.867	8
Unresolved constructability issues with design that could affect project objectives in the construction phase of airport development	41	3.54	1.002	9
Financial discrepancies in terms of funding and project cost due to misinterpretation of project size.	41	3.51	1.003	10
Government interference in the determination of the size of the construction project.	41	3.49	1.121	11
Delay/Failure by government to commission constructed facilities leading to delays in the seasonal operation of the Airport	41	3.49	1.052	12
Project schedule delays caused by contractor and contract related issues	41	3.46	.897	13
Legal lawsuits from parties affected by the location of the Airport infrastructure.	41	3.44	.896	14
Government interference in the determination of changes of construction project being undertaken at Airports.	41	3.41	1.048	15
Price inflation of construction materials and expensive construction work methods engaged by contractors affecting airport owner budget for infrastructure development	41	3.37	.968	16
Inadequate analysis done to determine sufficient land area for airport development that require permit protection which will affect present and future airport development to be done at the Protected airport land area.	41	3.37	1.043	17

Tight project schedule constraints occurring as a result of inadequate determination of project size.	41	3.32	1.105	18
Airport owner interference in the design and construction phase of this delivery method.	41	3.27	1.162	19
Project schedule affected by delays in approval process associated with land procurement.	40	3.15	1.075	20
Possible labor strike affecting construction process	41	3.12	.980	21
Land owners unwilling to sell identified land for airport development.	41	3.02	1.151	22
Chosen airport location does not fit with the proposed planning, development and operation of airport facility affecting overall development process	41	2.93	1.058	23
Agricultural landowners unwilling to sell land for airport development purposes.	41	2.85	1.108	24
Local communities pose objection to airport development on land within their activity.	41	2.85	1.195	25
Local community opposition to airport capital development	41	2.80	1.167	26

Source: Field Data (2019)

4.4 TO IDENTIFY THE IMPACT OF THESE RISKS ON THE CONSTRUCTION PROJECTS IN AN OPERATIONAL AIRPORT FACILITY

The impact of construction risks can be either severe, major, medium, minor or negligible depending on its intensity. The knowledge of the existence on risks is not enough, contractors need to know its impact and how it is affecting the progress of the construction works. This

will enable the contractors to know how to address these risks. The same risks on the construction projects in an operational airport facility was presented to the respondents to identify their level of impact on the success of projects on a scale of 1-5 with 1= Severe 2=Major 3= Medium 4=Minor 5=Negligible.

With regards to the impact of these risk factors on construction projects, *Agricultural landowners unwilling to sell land for airport development purposes* was ranked 1st with a mean of 3.22. This means among all the risk factors, this has the highest impact though its impact level is approximately medium because if its mean. When the expansion of sections of the airport facilities affects the lands of citizens, it has the ability to negatively affect the project timelines especially if it is an agricultural land. It can lead to litigation thereby affecting the project success. *Local community opposition to airport capital development* emerged 2nd with a mean of 3.20. When public funds are used for infrastructure projects that the public deems as not warranted for, they can oppose which can affect the success of the project. indicating the impact of this factor on project success is medium. *Chosen airport location does not fit with the proposed planning, development and operation of airport facility affecting overall development process* ranked 3rd with a mean of 3.00. *Possible labor strike affecting construction process* with a mean of 3.00 was ranked as 4th. However, both the ranked 3rd and 4th factors had equal mean, therefore, the standard deviation was used to rank both factors. *Land owners unwilling to sell identified land for airport development* was ranked as 5th with a mean of 2.95.

Table 4.3: Impact of these risks on the Construction Projects

Construction risk Factors	N	Mean	Standard Deviation	Ranking
Agricultural landowners unwilling to sell land for airport development purposes	41	3.22	1.275	1
Local community opposition to airport capital development	41	3.20	1.229	2
Chosen airport location does not fit with the proposed planning, development and operation of airport facility affecting overall development process	41	3.00	1.140	3
Possible labor strike affecting construction process	41	3.00	1.183	4
Land owners unwilling to sell identified land for airport development	41	2.95	1.244	5
Tight project schedule constraints occurring as a result of inadequate determination of project size.	41	2.90	.944	6
Local communities pose objection to airport development on land within their activity	41	2.88	1.187	7
Project schedule affected by delays in approval process associated with land procurement.	41	2.88	1.144	8
Airport owner interference in the design and construction phase of this delivery method. Legal lawsuits from parties affected by the location of the Airport infrastructure.	41	2.78	1.037	9
Government interference in the determination of changes of construction project being undertaken at Airports.	41	2.71	1.123	10
Project schedule delays caused by contractor and contract related issues	41	2.68	1.213	11

Unresolved constructability issues with design that could affect project objectives in the construction phase of airport development	41	2.68	1.035	12
Inadequate analysis done to determine sufficient land area for airport development that require permit protection which will affect present and future airport development to be done at the Protected airport land area	41	2.68	1.035	13
Occurrence of disputes between parties involved in the project over parameters that determine project completion	41	2.66	1.109	14
Delay/Failure by government to commission constructed facilities leading to delays in the seasonal operation of the Airport	41	2.63	1.043	15
Price inflation of construction materials and expensive construction work methods engaged by contractors affecting airport owner budget for infrastructure development	41	2.63	1.019	16
Government restrictions on funding for certain airport maintenance projects	41	2.54	.977	17
High Security and safety related issues causing delay in the construction process and affecting project cost	41	2.46	1.185	18
Construction activities interference with airport operation activities	41	2.41	1.048	19
Financial discrepancies in terms of funding and project cost due to misinterpretation of project size.	41	2.41	1.048	20
Delay in acquiring permits and additional information required to carry out construction project associated with infrastructural development	41	2.39	.945	21

Government interference in the determination of the size of the construction project.	41	2.37	1.157	22
Tight project schedule affected by long bureaucratic approval procedures within government agencies	41	2.37	.942	23
Changes in government funding for the fiscal year affecting project schedule	41	2.34	1.015	24
Government agency identifying excessive project cost that results in loss of interest to fund construction project.	41	2.29	1.031	25

Source: Field Data (2019)

4.5 MITIGATION STRATEGIES USED TO MANAGE RISK IN AN OPERATIONAL AIRPORT ENVIRONMENT

In the last four decades the risk management research has grown considerably in the construction industry (Forbes et al., 2008) given that construction projects are exposed at the time of their coming into existence (Schieg, 2006) and are perceived to have more inherent risk due to the involvement of many contracting parties such as owners, contractors and designers (El-Sayegh, 2008). Contractors have to traditionally use high mark-ups to cover for risk (Baloi and Price, 2003). The risk management strategy from a contractual perspective is to allocate the risks, in the contracts among parties in such a way as to enable risks to be managed efficiently and effectively throughout the construction process (Shirolkar et al., 2017). The level of risks increases in the beginning of a project and it reaches its highest level during the tendering process where the project uncertainty is at its peak. The early involvement of risk management creates better conditions for the contractors. Risk management is defined as the process of identifying and assessing risk, and to apply methods

to reduce it to an acceptable extent (Tohidi, 2011). Smith (1999) also defines risk management as having understanding concerning a project and taking into consideration better decision in regards to the management aspect of the project in the future. Contractors play a major role in dealing with risks in construction. They are in charge of successful managing risk in construction (Treceno et al., 2003).

Risk control was ranked as 1st with a mean of 4.29. *Risk reduction* was ranked as 2nd with a mean of 4.05. In controlling risks some of the options include rejection, avoidance, delay, transference, spreading, compensation and reduction. For each hazard, risk controls that will reduce the risk to an acceptable level must be prioritized.

Risk elusion and/or avoidance is mostly perceived as the definitive mitigation strategy in that it suggests the projects may be terminated. This process of mitigation comprises the elimination of the cause of risk and the risk itself. The respondents responded that *risk avoidance* is mostly used and it was ranked as 3rd with a mean of 3.98. In using risk avoidance techniques, some of the examples comprise the use of exemption clauses in contracts, either to avoid certain risks or to avoid certain consequences flowing from the risks.

Table 4.4: Risk Management Practices

Risk Management practices	N	Mean	Standard Deviation	Ranking
Risk Control	41	4.29	.750	1
Risk reduction	41	4.05	.740	2
Risk Avoidance	41	3.98	.987	3
Risk sharing	41	3.83	.919	4
Risk Retention	41	3.54	1.051	5
Risk Transfer	41	3.29	1.250	6

Source: Field Data (2019)

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter presents the summary and major findings of the study, the conclusions drawn from the study and the recommendations made. The findings that were made from this study were summarized under each respective objective.

5.2 SUMMARY OF FINDINGS

5.2.1 Objective One: To identify construction related risk factors which occurs within an operational environment being Kotoka International Airport.

From the survey it was realized that the five most occurring risks associated with construction projects in an operational airport environment from the contractors were; Tight project schedule affected by long bureaucratic approval procedures within government agencies, Government agency identifying excessive project cost that results in loss of interest to fund construction project, Government restrictions on funding for certain airport maintenance projects, high Security and safety related issues causing delay in the construction process and affecting project cost, and changes in government funding for the fiscal year affecting project schedule.

5.2.2 Objective two: To identify the impact of these risks on the construction projects in an operational airport facility

It should be known that the knowledge of the existence on risks is not enough, contractors need to know its impact and how it is affecting the progress of the construction works. Therefore, risks identified in objective 1 was presented to the respondents to rate their impact on project success in an operational airport environment on a scale of 1-5 with 1= Severe 2=Major 3= Medium 4=Minor 5=Negligible. From the respondents, the 5 topmost risk which had their impact levels a little above medium with a mean of a little over 3.00 were; Agricultural land owners not willing to sell land for airport development purposes, Local community opposition to airport capital development, Chosen airport location does not fit with the purposed planning, development and operation of airport facility affecting overall development process, possible labor strike affecting construction process and land owners unwilling to sell identified land for airport development.

5.2.3 Objective three: To propose mitigation strategy pertaining to risk related construction at Kotoka Internal Airport.

After the identification of risks and their impact levels on construction projects, the next step is to identify how they can be mitigated. The mitigation strategies that are commonly used in risks management are; Risk Control, Risk reduction, Risk Avoidance, Risk sharing, Risk Retention, and Risk Transfer. The respondents were asked to tick the mitigation strategies that they commonly apply on risks that are encountered on projects.

5.3 CONCLUSION

In conclusion risk is a multi-facet concept and the construction project is plagued with various risks in all the stages of the life cycle of the project. Risks are therefore typical in airport construction and these risks are the causes of delays or cost overruns that can occur in a project.

Safety rules and regulations pertaining to works at Airports must be fully understood and complied by construction project contractors selected to work at Airports. The knowledge of the existence on risks is not enough, contractors need to know its impact and how it is affecting the progress of the construction works.

5.4 RECOMMENDATIONS

The following recommendations are made from the findings of the research being conducted;

1. Thorough risk assessments must be conducted at the early stages of the project life cycle by the contractors and the project management team in order to manage and mitigate these risks.

2. The management of Kotoka International Airport (K.I.A) must document risks that are frequent on their construction projects in addition to their mitigation strategies. This would be used as a guidance document for any contractor who may want to undertake projects at K.I.A.

5.4.1 RECOMMENDATIONS FOR FURTHER STUDIES

The following recommendations are made for future studies

1. Research in the future should be conducted in exploring the implementation of effective and efficient risk management plans in an operational Airport environment.

This implementation should include drafting policies to address these construction risk factors

2. Researchers can conduct a dissertation on assessing project risk management plans in Ghana's domestic Commercial airport environment. This is relevant since the Aviation Industry in Ghana is undertaking major infrastructural development project as the industry seeks to construct Domestic commercial Airports in all the regions.

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APPENDICES

SURVEY QUESTIONNAIRE

Topic: Exploring Construction Risk Factors in an Operational Airport Environment at Kotoka International Airport

Dear Sir/ Madam

I am an MSc student at Kwame Nkrumah University of Science and Technology (KNUST) currently undertaking a research on **Exploring Construction Risk Factors in an Operational Airport Environment at Kotoka International Airport.** The research is ongoing under the supervision of Prof. Theophilus Adjei-Kumi and requires a questionnaire survey to be undertaken to collect data from professionals in the construction companies undertaking projects at Kotoka International Airport responsible. Your experience and knowledge in the area of the research is very important and much appreciated. The information you shall provide shall be STRICTLY CONFIDENTIAL and for academic purposes only and findings from this research will be made available to you on request.

Yours Sincerely,

Kwao Odiko Solomon-Ayeh

M.Sc. Construction Management Student, KNUST

SECTION A

1. What is your highest level of education?

   [ ] HND [ ] BSc [ ] MSc [ ] PhD [ ] other …….

2. How many years of experience do you have in the construction industry?
   [ ] Less than 4 years [ ] 4-8 years [ ] 8-12 years [ ] 12-16 years

   [ ] Above 16 years

3. What contractor's classification certificate do you possess?

D1K1 [ ] D2K2 [ ] D3K3 [ ] D4K4[ ] A1B1 [ ] A2B2 [ ] A3B3 [ ] A4B4[

Others please specify……

4. How many construction projects have you executed at Kotoka International Airport?
   [ ] Less than 4 years [ ] 4-8 years [ ] 8-12 years [ ] 12-16 years

   [ ] Above 16 years

5. **Below are construction related Risk factors which occurs within an operational Airport Environment such as Kotoka International Airport. Kindly indicate your level of agreement with the occurrence of these risk captured below. 1= Severe 2=Major 3= Medium 4=Minor 5=Negligible**

	Construction Related Risk Factors	1	2	3	4	5
	Financial discrepancies in terms of funding and project cost due to misinterpretation of project size.					
	Project schedule affected by delays in approval process associated with land procurement.					
	Tight project schedule constraints occurring as a result of inadequate determination of project size.					
	High Security and safety related issues causing delay in the construction process and affecting project cost					
	Unresolved constructability issues with design that could affect project objectives in the construction phase of airport development					
	Construction activities interference with airport operation activities					
	Project schedule delays caused by contractor and contract related issues					
	Occurrence of disputes between parties involved in the project over parameters that determine project completion					
	Price inflation of construction materials and expensive construction work methods engaged by contractors affecting airport owner budget for infrastructure development					
	Airport owner interference in the design and construction phase of this delivery method.					
	Government interference in the determination of the size of the construction project.					
	Government interference in the determination of changes of construction project being undertaken at Airports.					
	Delay/Failure by government to commission constructed facilities leading to delays in the seasonal operation of the Airport					
	Government restrictions on funding for certain airport maintenance projects					
	Changes in government funding for the fiscal year affecting project schedule					
	Government agency identifying excessive project cost that results in loss of interest to fund construction project.					
	Tight project schedule affected by long bureaucratic approval procedures within government agencies					
	Delay in acquiring permits and additional information required to carry out construction project associated with infrastructural development					
	Inadequate analysis done to determine sufficient land area for airport development that require permit protection which will affect present and future airport development to be done at the					

	Protected airport land area					
	Chosen airport location does not fit with the proposed planning, development and operation of airport facility affecting overall development process					
	Local communities pose objection to airport development on land within their activity					
	Land owners unwilling to sell identified land for airport development					
	Local community opposition to airport capital development					
	Agricultural landowners unwilling to sell land for airport development purposes					
	Possible labor strike affecting construction process					
	Legal lawsuits from parties affected by the location of the Airport infrastructure.					
	If any please add					

6. **To Identify the Impact of These Risks On the Construction Projects in an Operational Airport Environment. Please select your level of agreement of these impact below.**

1= Severe 2=Major 3= Medium 4=Minor 5=Negligible

	Construction Related Risk Factors	1	2	3	4	5
	Financial discrepancies in terms of funding and project cost due to misinterpretation of project size.					
	Project schedule affected by delays in approval process associated with land procurement.					
	Tight project schedule constraints occurring as a result of inadequate determination of project size.					
	High Security and safety related issues causing delay in the construction process and affecting project cost					
	Unresolved constructability issues with design that could affect project objectives in the construction phase of airport development					
	Construction activities interference with airport operation activities					
	Project schedule delays caused by contractor and contract related issues					
	Occurrence of disputes between parties involved in the project over parameters that determine project completion					
	Price inflation of construction materials and expensive construction work methods engaged by contractors affecting airport owner budget for infrastructure development					
	Airport owner interference in the design and construction phase of this delivery method.					
	Government interference in the determination of the size of the construction project.					
	Government interference in the determination of changes of construction project being undertaken at Airports.					
	Delay/Failure by government to commission constructed facilities leading to delays in the seasonal operation of the Airport					
	Government restrictions on funding for certain airport maintenance projects					
	Changes in government funding for the fiscal year affecting project schedule					
	Government agency identifying excessive project cost that results in loss of interest to fund construction project.					
	Tight project schedule affected by long bureaucratic approval procedures within government agencies					
	Delay in acquiring permits and additional information required to carry out construction project associated with infrastructural development					
	Inadequate analysis done to determine sufficient land area for airport development that require permit protection which will affect present and future airport development to be done at the Protected airport land area					
	Chosen airport location does not fit with the proposed planning, development and operation of airport facility affecting overall					

	development process					
	Local communities pose objection to airport development on land within their activity					
	Land owners unwilling to sell identified land for airport development					
	Local community opposition to airport capital development					
	Agricultural landowners unwilling to sell land for airport development purposes					
	Possible labor strike affecting construction process					
	Legal lawsuits from parties affected by the location of the Airport infrastructure.					
	If any please add					

7.

Identify The Risk Management Practices Used in an Operational Airport Environment.

1= Rarely 2= Not Frequent 3= Uncertain 4= Frequent 5= More Frequently

		1	2	3	4	5
	Risk Retention					
	Risk reduction					
	Risk sharing					
	Risk Control					
	Risk Avoidance					
	Risk Transfer					
	If any please add					