MANAGEMENT OF BUILDING COLLAPSE RISKS IN NIGERIA: A POST MORTEM INVESTIGATION

BY

OBODOH DOMINIC ANOSIKE (B.Sc, M. Eng)

20074583868

DEPARTMENT OF PROJECT MANAGEMENT TECHNOLOGY
FEDERAL UNIVERSITY OF TECHNOLOGY
OWERRI

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CERTIFICATION

This is to certify that this work "Management of Building Collapse Risks in Nigeria: A Post Mortem Investigation" was carried out by I, Obodoh Dominic Anosike (20074583868) in partial fulfillment for the award of the degree of (Ph.D in Project Management Technology in the Department of Project Management Technology) of the Federal University of Technology, Owerri.

Prof. C. C. Nwachukwu
(Principal Supervisor)
01/02/2022
Date

Prof E. C. Ubani
(Co-Supervisor)
01/02/2022
Date

Dr C.I. Anyanwu
(Co-Supervisor)
02/02/22
Date

Dr I.I. Echeme
(HOD, Project Management Technology)
3/11/2022
Date

Prof. O.T. Ebiringa
(Dean, SMAT)
03/11/2022.
Date

Prof. B. O. Esonu
(Dean, PGS)
Date

Prof. A. C. Ezirim
(External Examiner)
Date

Dedication

This work is dedicated to my lovely wife Dr (Mrs) Chikasi Obodoh and children

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ABSTRACT

The study focused on the management of building collapse risks (BCR) in Nigeria: A post mortem investigation. Management of building collapse risks has been saddled with a lot of challenges which had led to continuous rise in the risks associated with building collapse. The main objective of this research is to investigate the management of building collapse risks in Nigeria with a view to developing a framework for effective management and reduction of losses associated with building collapse in Nigeria. To achieve the main objective of the study, five specific objectives were pursued and four hypotheses were formulated to guide the study. A survey research design was adopted for data collection. The population of study was made up of key professionals in the building industry, Staff of emergency management agencies, as well as the neighbourhood of the collapsed building in the study areas and the total population is 24,229. A sample size of 1997 was determined using Taro Yamane formula for finite population, while the samples were selected using stratified random sampling technique. A total of 1860 correctly filled and returned copies of the questionnaire, representing 93% of the distributed copies of the questionnaire was used for data analysis. Data were presented using tables, bar charts and piecharts, while analysis was done using percentages, mean and relative important index (RII). The hypotheses were tested using analysis of variance (ANOVA) and principal component analysis (PCA) via SPSS, version 23 and Minitab 18. The following findings were made from the analysis: (i) The existing system of managing building collapse risks in Nigeria is poor, ineffective and cannot adequately be used to address the risks associated with building collapse. (ii) The building collapse risks that mostly impact on the building development and Nigerian economy are economic/financial risks and human related risks. (iii) The prominent challenges faced by emergency management agencies are: lack of adequate funding, coordination and collaboration, poor urban planning, etc. (iv). The study developed and validated a framework for effective management of risks associated with building collapse in Nigeria, which is the major contribution to knowledge. The study therefore recommends adequate funding and monitoring of emergency management agencies, coordination and collaboration network among all stakeholders involved in disaster management, among others.

Keywords: Management, building collapse risks, disaster management, framework, emergency management agencies, Nigerian economy, stakeholders, risks, critical success factors.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Building collapse is usually associated with some risks, known as "building collapse risks" (BCR), which cause negative impacts on the stakeholders in the built environment.

Building collapse risk can be described as an event or action that could cause negative impacts or consequences on the building users, investors, stakeholders and the general public, and hence affect the project objectives ((Akande, Debo-Saiye, Akinyobi, Alao & Akinrogunde 2016). The building collapse risks include: loss of lives, loss of physical properties and destruction of movable properties. Beyond this, building collapse always has far reaching economic, financial, psychological and sociological implications (Oloke, Oni, Ogunde, Opeyemi & Babalola, 2017). Investment ideas are frustrated and those who have a stake in it become temporarily or permanently destabilized or frustrated. From this perspective, building collapse risks can be observed as "threats to success".

The issue of building collapse could be attributed to lack of project management or absence of professional project manager from the inception to completion of such building project. Project management is believed to be a means of avoiding the ills inherent in the construction and production sectors of the economy and for which reasons most projects fail and or abandoned (Nwachukwu, 2016). The project manager is a technical expert to take charge and control event on project implementation process. According to Nwachukwu (2016), a project manager is someone who understands the intricacies of coordinating, controlling, organizing and directing the efforts and activities of the professional team and the physical problems of implementation process with the needs in the decision making process. The success of any project implementation process in the construction industry depends largely on early appointment of a professional project manager, who takes the charge of coordinating and controlling the activities of the professional team.

In the past 30 years, there have been multiple incidences of building collapse which have resulted in avoidable loss of lives, destruction of property and other valuable resources. The quality of the built environment, both natural and man-made depends on its management.

Risks associated with building collapse in Nigeria need to be identified and managed, if their impact on the economy could be reduced or if possible eliminated.

Building collapse is a phenomenon characterized by the compromise in the structural integrity of building component, resulting in its eventual failure (Bala, 2017). This phenomenon has multiplying alarming effects on the Nigerian populace in recent times. For instance, on the 13th March 2019, a four storey School building collapsed in Lagos killing over 20 pupils, two-storey building collapsed in Ibadan with properties lost (15th March, 2019), seven-storey building collapsed in Port Harcourt (23/11/2018) with five people confirmed dead and numerous properties destroyed, four-storey building collapsed at Jabi Abuja (16th August, 2018) with two dead and many trapped in the rubbles, Synagogue church building collapse in Lagos (12th September, 2014) that claimed the lives of over 116 people, 8 – Storey building collapsed at Yardua Drive, Owerri (April 30, 2020) with 4 deaths recorded and 7 injured, Multi-storey building under construction collapsed (October 12, 2020) at Obalende Lagos Island and claimed the lives of eight persons, 2- Storey building collapse at Dawaki Modern Market, Abuja (25th July, 2020) with no death recorded, to mention but a few.

Building collapse is usually caused by some factors which include: non compliance to the planning regulations, building without approved building drawings, alteration of approved drawing (the case of 7 – storey building collapse in Port Harcourt, 2018) and absence of a professional project manager in the implementation process, to mention but a few.

In order to tackle the cases of building collapse and the associated risks, the Nigerian government at different periods made laws and other efforts to guide the building development and to curb or forestall the incidences of building collapse and associated risks. In 1992, the government enacted the Nigerian Urban and Regional Planning Act No. 88 of 1992 to facilitate the preparation and implementation of development plans and planning scheme with a view to establishing a better environment for living, working and recreation. Also, the Act was also meant to give more seriousness to building development control among other specific objectives. The government also established the disaster management agencies for the purpose of managing disasters in Nigeria such as fire, building collapse, flooding, landslides, etc. These agencies include National Emergency Management Agency

(NEMA), State Emergency Management Agency (SEMA), Local Emergency Management Agency (LEMA), Nigeria Fire Service, Red Cross Society, to mention but a few.

These emergency management agencies are usually faced with numerous challenges which affect their effective management of disasters in Nigeria such as building collapse. The challenges include: lack of collaboration, poor funding – such that they lack the financial capacity to seek assistance from the multinational companies for heavy equipment during emergency situations, lack of coordination and control amongst many emergency management agencies – each of these agencies is in the world of its own and can only take instructions from the head of that particular agency. This results to chaos and confusion during emergency situations. If an agency is headed by a project manager and such an agency is charged with the statutory responsibilities of coordination and control of the activities of all other agencies saddled with the responsibilities of emergency management, more lives and properties will be saved in event of building collapse. Sometimes, the agencies find it difficult to access the building collapse sites with heavy equipment due to poor urban planning in the neighbourhood. This undermines the performance of these agencies in event of building collapse – the case of Synagogue Church building collapse in Lagos, which led to the death of over 116 people which some could have been rescued.

In spite of the above efforts by governments and management agencies to reduce or eliminate the risks associated with building collapse in the Nigerian built environment, the phenomenon appears to be on the rise. Studies discussing building collapse risks in Nigeria have been peripheral (Oloke et al, 2017; Oseghale et al, 2015 & Ejiofor, 2018). With the increasing rate of building collapse risks, detailed investigation is required. It therefore becomes necessary to carry out a detailed research on the subject matter with a view to finding better strategies of enhancing efficient and effective management of building collapse risks geared towards reducing or eliminating the sufferings of victims of building collapse in Nigeria. Also, building collapse risks if not checked by all standards, would create a vacuum in the supply-demand dichotomy of the property market, which otherwise would have brought about economic growth and development to the nation.

1.2 Problem Statement

Despite government efforts towards the management of disasters in Nigeria, the management of building collapse risks (BCR) is still saddled with a lot of challenges. The result has been an increased incidents of building collapse and its attendant risks, in the form of loss of life and properties, etc. (Adeniran, 2013). These challenges could be as a result of ineffective or nonexistent management framework(s) that could lead to under performance and negative outcomes. Unfortunately, research efforts have not clearly been directed towards detailed investigation of the management of building collapse risks in Nigeria.

Existing studies focused on the development of framework for post-development management control (Oloke et al, 2017), management of collapse accidents during development process (Yan and Kias, 2018) and Building regulation (World Bank, 2019)

Aside this, existing frameworks for the management of disasters in Nigeria are either not directed towards the management of building collapse risks or are ineffective. For example, the establishment of NEMA and other sister agencies has not actually yielded the desired results in the management of building collapse risks in Nigeria

In view of this, several questions surrounding the management of building collapse risks in Nigeria have remained unanswered. These include the problem of the processes of managing the building collapse risks, the impacts of building collapse risks on building development and economy, the challenges faced in the management of building collapse risks, the critical success factors for effective management of building collapse risks and the framework for effective management of building collapse risks in Nigeria. It is in the course of the foregoing issues, that this study seeks to investigate the management of building collapse risks in Nigeria.

1.3 Objectives

The main objective of the study is to investigate the management of building collapse risks in Nigeria with a view to developing a framework for effective management and reduction of losses associated with building collapse. To achieve the main objective, the following specific objectives were provided to:

1. Analyze the existing system of managing building collapse risks in Nigeria

2. Determine the impact of building collapse risks on building development and Nigerian economy

3. Examine the challenges faced by the management agencies in the management of building collapse risks in Nigeria

4. Establish the critical success factors for effective management of building collapse risks in Nigeria.

5. Develop and validate a framework for effective management of building collapse risks in Nigeria.

1.4 **Hypotheses**

The following hypotheses were postulated to strengthen and achieve the main objective of the study:

Ho_1: There is no significance impact of the identified building collapse risks on the Nigerian economy.

Ho_2: The processes employed in the management of building collapse risks in Nigeria have not significantly reduced the impacts of building collapse.

Ho_3: The challenges faced by the management agencies have no significant effect in the management of building collapse in Nigeria.

Ho_4: There is no significant difference between the developed model of managing building collapse risks and the existing system.

1.5 **Justification of the Study**

The incidences of building collapse in Nigeria are posing serious challenges to all the stakeholders in the building industry: building consultants, developers, governments, landlords and users, as well as the residents and the general public. Numerous lives and properties worth billions of naira have been lost and construction workers/users of the building facilities are rendered permanently disabled as a result of building collapse. The Nigerian society continues to lose the contributions of such victims towards the socio-economic development of the country. Previous researchers were predominantly concerned about diagnosing and highlighting the causative factors, effects and remediation measures of building collapse without looking into the risks therein and how such risks could be effectively managed. This research is therefore very necessary because it seeks to bridge this gap by providing information on ways of enhancing effective management of building collapse risks in Nigeria.

The successful investigation of the management of building collapse risks in Nigeria and suggesting ways of enhancing effective management will in no small measure contribute to the permanent solution towards alleviating the suffering of victims of building collapse. The study will help to reduce the effect of loss of lives and properties associated with the building collapse thereby increasing general economic development and the building industry in particular.

Investors in the building sector will also benefit as identification and tackling of these building collapse risks will help in reducing negative impact of building collapse on the stakeholders thereby helping them to realize their investment objectives. The Nigerian government will immensely benefit from the study as scarce resources and human lives often wasted in public projects due to building collapse will drastically be reduced, if not eliminated.

The study will be of immense benefit to researchers, students and academics in related disciplines as it will serve as a reference material and provide a data base for the construction industry and will also add to few available literatures in the subject matter. It will provide clear understanding/awareness of potential risks in building collapse, how such risks could be effectively managed and a better view of possible consequences resulting from unmanaged risks and how to avoid them.

It will also ensure increased level of control over the whole building project and more efficient problem solving processes which can be supported on a more genuine basis.

1.6 Scope of the Study

The causes and effects of building collapse in Nigeria have been dealt with extensively by many authors, whilst the management of building collapse risks (BCR) is still poorly or ineffectively handled. The main objective of the study is to investigate the management of BCR in Nigeria with a view to developing a framework for effective management and reduction of losses associated with building collapse. The study focused on the management of the building collapse risks in both private and public buildings in selected five cities in Nigeria: - Abuja, Owerri, Ibadan, Port Harcourt and Lagos, representing four out of six geo-political zones in Nigeria. The choice of the cities is based on rate of occurrence of building collapse, concentration of building activities, population pressure and high economic activities in the four zones in Nigeria. The work also concentrated on buildings that collapsed from 2009 to 2020 in Nigeria. The building collapse risks considered in the study are Economic/Financial risks, Socio-Political risks, Human related risks, Environmental risks, Physical risks and Law/Legal risks. Any other building collapse risks apart from the above were not considered.

CHAPTER TWO

LITERATURE REVIEW

2.1 Conceptual Review

Concepts are ideas, attributes or processes. Odumegwu (2017) suggests that it could be derived from previous studies, relevant theories, and views of practitioners, professionals or anyone that has expertise or experience related to the topic of the study and also from personal intuition/conceptions. In this work, concepts relating to risk, risk management, building collapse risks, risk management framework, disaster/emergency management were explained

2.1.1 Risk, Uncertainty and Opportunity

The process of decision making takes place in an environment that has three components: certainty, uncertainty and risk (Flanagan and Norman, 1993). Certainty can be described as a situation or event where all the factors can exactly specified and well known by the decision maker and which hardly happen often in the construction industry. Uncertainty can also be stated as a situation whereby the decision making process is related with the future. The word "uncertainty" according to Raftery (1994) is a situation where it is impossible to describe the probability of occurrence of an event. Risk on the other hand, can be defined as a situation or event where the actual outcome of an activity does not conform with the estimate or forecast value. Therefore, the major difference between risk and uncertainty is in terms of its quantification. Risky situations/events have quantifiable attributes whereas uncertainty situations are not quantifiable.

Royal Society (1991) broadly defined risk as the probability that an adverse event occurs during a stated period of time. Though, this definition considers the negative side of risk only. Porter (1981), Perry and Hayes (1986) expressed risk as exposure to economic loss or gain. Also Chapman (1990), defined risk as "exposure to possible economic and financial loss or gain, physical damage, or delay as result of the uncertainty associated with pursuing a particular course of action". This statement can be seen as an explicit definition of risk that arises from significant uncertain situations. Risk can be seen to exist when a decision is expressed in terms of a range of possible outcomes and unknown probability attached to those outcomes. Also, uncertainty exists where there is more than one possible outcome of a course

of action and the probability of each outcome is not known. As the construction industry is complex in nature because of the parties involved, methods applied and activities executed, so will it be dealing with risks. To add to the above definition of risk, project risk can be described as an event or action which has the tendency to cause a negative impact on achieving project performance, and this includes project scope, quality, schedule and cost. From this point of view, risk can be seen as "threats to success". This therefore, requires a system approach to deal with risks. Flanagan and Norman (1993) defined risk management as a discipline for living with the possibility that the future event may cause adverse effects. Though this definition correlates the term risk with the possibility of bad consequences or effects, it can also refer to possibility of opportunities. According to Chapman and Ward (1987), the aim of risk management is to remove or reduce the possibility of underperformance. They stated that the fundamental or essential purpose of risk management is to improve on project performance by systematic identification, appraisal and management of project related risks. On the other hand, Dikmen et al (2004)defines risk management as an objective functions to represent the expected outcomes of a project, measuring the probability of achieving the objectives by generating different risk situations to ensure the attainment/exceeding the preset objectives.

2.1.1.1 Concept of Risk

The term risk is used in everyday life to describe the detrimental effects of uncertainty or gambling effects on uncertain situations. According to Oxford Advanced Learner's Dictionary of Current English (8th edition) defines risk as:

- The possibility or chance of meeting danger, suffering loss or injury, etc
- The possibility of a person or thing causing problem or danger some time in future.
- At risk – in danger of something unpleasant or harmful happening.
- To act in spite of the possibility of injury or loss
- To take or run a risk, to proceed in an action without regard to the possibility of danger involved.

Looking at the above definitions of risk, the word possibility is used four times. This is an indication of the nature of risk and that it arises out of an action of uncertainty. In our World today, there are many uncertainties but it is only the ones that have detrimental effects on our

lives that we consider as risks. Examining the last two definitions may lead to the question "Why" Why do we expose ourselves or properties to danger or loss, or act in spite of the possibility of injury or loss?. The obvious logical answer must be that, there is possibility of gain or benefit that will be achieved only if we place ourselves at risk. If risk is the downside of uncertainty, the opportunity or possibility of gain can be described as the upside of uncertainty. If it is possible, we will be looking for only the opportunities that arise from uncertainty situations and avoid the risks. However, since the two are linked in some way, we try to balance the risks we are exposed to with the opportunity which they bring. The balancing forms the bases for the decisions which we take to plan our future. The balance between risks and opportunities which we accept will be dependent on the perceived risks and opportunities we seek and the risks we are ready to accept. For the purpose of this study, Risk is an uncertain event or condition whose outcomes can be detrimental to the attainment of the project objectives.

2.1.1.2 Uncertainty

The term uncertainty is inherent in the construction industry. This perhaps to a greater extent than any other industries because of its interface with the earth,. Uncertainty arises due to our inability to accurately predict the outcome of future events. An event could refer to many things such as, delivery of materials, availability of labour, weather conditions, material cost, and when they can be utilized. Also, uncertainties can manifest itself in the inability to predict if an event will occur or not and the effect if that event occurs. From the above example, the materials are going to cost money; there is no uncertainty about that, but there may be uncertainty about the cost. On the other hand, there is uncertainty about the suitability of the material for its purpose and where it is not, the degree of the unsuitability. For the purpose of this study, Uncertainty can be defined as an event whose outcome cannot be accurately predicted. This shows that the degree of uncertainty depends on the accuracy of the predictions.

2.1.1.3 Opportunity

The upside of uncertainty is the opportunity and (Flanagan and Norman, 1993) in their study on risk management acknowledge the importance of opportunity when assessing risk. Opportunity as used in this study is defined as uncertain event whose outcomes can be beneficial to the attainment of the project objectives.These definitions of risks and opportunities presented therefore, classify all uncertainty situations which affect our objectives.

2.1.1.4 Riskiness

The stated definitions above about risk and opportunity classify the probable outcomes of an uncertainty into beneficial and detrimental. With this definitions, one can determine whether an uncertainty is risk, opportunity, or both. An uncertainty can said to be both a risk and an opportunity, if it has possible outcomes in which one would be beneficial and the other detrimental. However, there is a need to classify the extent by which uncertainties are risks and opportunities to allow better comparisons and decisions to be taken regarding their acceptability. When risks are defined to produce a numerical value, such risks do classify the risks as the higher the value, the riskier the uncertainty. An example of a single outcome of an uncertainty is the definition by British Standard Institute (1979) which defines risk as "The combined effect of the probability f occurrence of an undesirable event, and the magnitude of the event".

However, there is the need to classify the riskiness of an uncertainty putting into consideration all its possible outcomes. Thus, a risk can be uncertainty with more risky outcomes tha opportunities. This does not necessarily mean addition of the number of outcomes that are risks and those that are opportunities, the magnitude of each of the outcomes has to be taken into account.

Therefore, risk has two meanings; it can be described as an undesirable outcome of an uncertainty, or an uncertainty with a balance between the risk and opportunity outcomes in favour of the risks. Also, an opportunity can be seen in a like manner.

2.1.2 Risk, Perception and Affinity

The risk and opportunity definitions as stated above refer to the possible outcomes of uncertainties for future events. The possible outcomes could be made from past events, but accurate historical data is usually unavailable in the construction industry as a result of its project based nature. Assessment of risks and opportunity is then based on their past experience. As a result two people with same objectives can make different assessments of the risk and opportunity

Therefore, the difference in the assessment is a function of the past experience of the people and their affinity or adversity to risk. The person who enjoys risk will accept the balance between risk and opportunity more than the person who is risk averse. Studies have shown that high risk ventures generally have expected returns, and troubled firms tend to take higher risks in a desperate attempt to make profit (Marsh & Swanson, 1984). Therefore, the level of risk which is considered acceptable is a function of the interpretation of the data available and the relative importance of the objectives, both of which are controlled by the people involved.

2.1.2.1 Determination of Risk

According to Ehsan, Alam, Mirza and Ishaque (2010), there are two methods available to determine risks in a project; namely the quantitative and qualitative methods. The quantitative methods relies on statistics to calculate the probability of risk occurrence and the impact of the risk on the project, while the qualitative approach relies on judgments and it uses criteria to determine outcome.

The most common way of applying the qualitative analysis is to use Decision Tree analysis which involves the application of probabilities to two or more outcomes. Also the use of Monte Carlo's Simulation Method generates value from a probability distribution and other factors. The qualitative approach also involves a list of processes of a project in descending order, calculate the associated risks with each process and list the controls that may exist for each risk.

2.1.3 Types of Construction Project Risks

There are different types of risks encountered in different stages of a construction project. These risks according to Abdul-Rahman (2006) can be classified broadly into nine groups as Physical risks in construction project, Political risks, Financial risks, Legal risks, Environmental risks, Logistic risks, Construction risks, Design risks and finally Management risks.

The understanding of the construction project risks and its classification could lead to clear decision-making. For example, the advantages or disadvantages of an acceleration of the project, the type of contract to be used, type of project funding and so on. Also, identification of risk in advance can lead to clear response procedures if the risks occur.

The classification of construction project risks can be grouped into nine categories and they are described as follows:

2.1.3.1 Physical Risks

These are the risks that are often associated with the physical nature of the project. The types of risks that fall under this category are usually regarded as uncontrollable source of risk. The types of risks within this category are uncontrollable, such as force majeure (acts of God), for example, inclement weather, flood, fire, landslide etc, occurrence of accidents, supply of defective materials, varied labour and equipment productivity and unexpected events or unforeseen circumstances (Abdul-Rahman, 2006)

2.1.3.2 Construction Risks

These risks occur during the construction phase in a project life cycle. The construction phase is one of the most critical phases in a project because any design changes made during this phase will affect to a great extent on cost, time and quality aspects. As a result of this fact, it is necessary for the stakeholders especially the contractors to give full concentration on the construction risks elements in carrying out their work. The types of risks that fall under this category include: delay in possession of site, possible failure of equipment which will certainly affect the productivity of the work, unavailability of equipment, inappropriate equipment, poor inventory management, design changes, late ordering of materials, unavailability of labour for both manual and management etc.(Abdul-Rahman, 2006)

2.1.3.3 Political Risks

The political risks in construction project can occur due to changes in law, war, revolution, civil disorder, hostility of host community, constraints on the availability of labour, customs and export restrictions etc. These risks adversely affect construction projects if unmanaged.

2.1.3.4 Financial Risks

Financial risk can be described as any risk associated with money. Financial risk in construction project consists of unavailability of funds, cash flow problems or insolvency due to slow payment and disputes, loss due to default of contractor, supplier etc, inadequate payment for variations, failure of low bidder to enter construction contract, inflation, exchange rate fluctuation, under pricing, credit worthiness of contractors etc.(Abdul-Rahman, 2006)

Many construction projects suffer from preventable financial problems. Underbids ask for too little money to complete the project. Cash flow problems exist when the present amount of funding cannot cover the current costs for labour and materials, and other expenses. Having sufficient funds all the time is very important to deliver a successful project.

2.1.3.5 Design Risks

The design risk can be defined as any potential risk in a design process, either in a concept design or a detailed design. The early assessment of design risk will increase the chances of eliminating possible failures, delays and reduce the impact of potential failures.

Design risks in construction projects comprise of incomplete and poorly defined design scope resulting from inability to comprehensively articulate owner and users' needs and requirements, unavailability of information and incomplete design information, late confirmation and approval of design etc.

2.1.3.6 Environmental Risks

This type of risk is a serious and growing issue in the construction industry. Environmental risks considerations can significantly reduce/minimize or eliminate a contractor's exposure to environmental liabilities (Abdul-Rahman, 2006).

Environmental risks in construction projects can consists of ecological damage, pollution, erosion, waste treatment, regulations and possible changes, geological/topographic limitation, weather, working space limitations etc.

2.1.3.7 Legal Risks

It is expected that a construction project must fit into the legal contractual framework governing the property. They include government regulations on the use of the property, and obligations that are created in the process of the construction,

The legal advisers in the beginning of a construction project seek to identify ambiguities and other potential sources of trouble in the contract structure, and to present options for preventing problems. Throughout the process of the project, they work to avoid and resolve conflicts that arise. Legal risks in construction project consists of direct liability, liabilities to others, local law and codes, legal differences between countries of client, contractors, Consultants, suppliers etc, conditions of contract i.e. liquidated damages, maintenance etc (Abdul-Rahman, 2006)

2.1.3.8 Logistic Risks

The logistic risks include: unavailable labour, materials and equipment, undefined scope of work, high competition in bids, inaccurate project program, poor communication between the home and field offices (contractors side).

Contractors believe that the risks of unavailability of labour and materials, and poor communication among contractors' teams are highly significant risks. The contractors' competition is a risk that contractors worry about. It is hard for contracting firms with high managerial costs to compete with firms with lower managerial costs. The unavailability of labour and materials is somehow connected to political situations. If closure of boarder takes place, materials will be subjected to increase in prices, undefined scope of work and inaccurate project program have severe effects on the project.

2.1.3.9 Management Risks

The management risks that are usually encountered in building construction projects include: ambiguous planning due to project complexity, resource management, changes in

management ways, information unavailability (include uncertainty), poor communication between involved parties etc.

Another important type of risk which was not considered by Abdul Rahman (2006) in his study is the Health and Safety risks which this study considers very important in attainment of project objectives in construction industry.

2.1.3.10 Health and Safety Risks

The Health and Safety risks that are usually prevalent on construction sites include: Organization leadership and culture, time pressure, use of equipment and specification of materials, Workers behavior and attitude, site conditions and weather, Design, plan details and size etc.

2.1.4 Risk Management

There are many definitions of risk management, just as there are of risk, and, similarly to the definitions of risk, the definitions of risk management are also inconsistent. This inconsistency, and hence confusion arises because of two aspects of the definitions. Firstly, as for risk, there are different definitions as to what risk management is, and secondly, different titles are sometimes given to a process which could be described as risk management. As examples, the following definitions of risk management rely heavily on the definition of risk used by the author but do introduce many of the fundamentals of risk management. Bunt (2004) sees risk management as the entire set of activities and measures that are aimed at dealing with any possible risks, in order to maintain control over a project; and Pmbok (2000) defines risk management as the systematic process of identifying, analyzing and responding to risk. The aim of managing risks is to achieve the project objective in terms of delivering the project to time, quality and cost.

For Flanagan and Norman (1993), “The aim is to identify, analyze, evaluate and operate on risks. The company is converting uncertainty to risk”. According to Royal Society (1981), “The whole complex process of decisions about risk: including risk elimination, risk evaluation and judgments on acceptability, taking into account public opinion”. Also Toakley and Ling (1991) defined risk management as “A technique aimed at controlling the level of risks and mitigating their effects”.

Abdul-Rahman, Wang and Mohamad (2015) in their own study defined risk management as a proactive decision-making process used to minimize and manage risks in the most efficient and appropriate manner.

The following definitions are of risk analysis but seem to refer to a similar process: “Risk analysis is the qualitative identification and subjective assessment and then a quantitative analysis. Risk management involves the formulation of management responses to the main risks” (Association of Project Managers, 1992)

Risk analysis is the identification of uncertainties, estimation of the natures and magnitudes of the uncertainties, articulation of the impact of the uncertainties on the execution of the projects, and formulation of a project plan, including appropriate contingency measures, which explicitly allows for the uncertainties (Klein, Powell and Chapman, 1994).

The above definitions describe the subject of risk management, to which all the authors contribute work, in many different ways. Indeed, because there is no consistency in the definition of risk, this is compounded in the definitions of risk management. Taking the definition by AlBahar and Crandall (1991), as an example, their definition of risk contains both the upside and downside uncertainty, and this affects the interpretation of their definition of risk management. When Flanagan and Norman (1993), describe the essence of the process as the conversion of uncertainty to risk, this can only be understood with reference to their definitions of risk and uncertainty.

There is also a disagreement on the matter of what should be the focus of risk management within construction. Many of the definitions define it in terms of construction projects. Although, construction projects are the major source of risk, the risks are ultimately to the company undertaking them and even when considering a project many aspects are beyond that project being considered. When risk is viewed purely from a business perspective, as in Bannister and Bawcutt (1981), the field of view is widened and risk management is defined in terms of a company and its operations. Indeed, Perry and Hayes (1985), identify the benefit of understanding the cumulative effects of projects risks but concede that this is not undertaken.

Many authors, rather than providing a definition of risk management, describe the process and, in doing so, definitions can be inferred. Risk management is described by many as a

three stage process, entailing identification, analysis, and response (Perry and Hayes,1985, Clark, Pledger, Needler,1990, Bannister and Bawcutt,1981, and Toakley and, 1991). Al-Bahar and Crandall (1991), add a fourth stage, referred to as system administration. The inclusion of this stage highlights the iterative nature of risk management, as it contains the monitoring of the risk management process. In responding to some risks, the effect of others can be changed or new risks produced or identified (Berny and Townsend, 1993). The iterative nature of risk management is easily illustrated using a flowchart, an example of which is shown in Figure 2.1

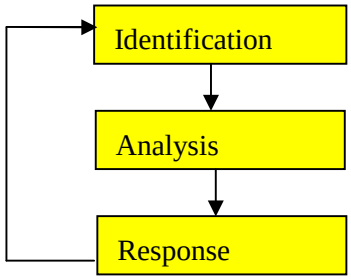


Figure 2.1: Flow Chart of the Risk Management Process

Source: Flanagan and Norman (1993)

Flanagan and Norman (1993), included further item into the process, referring to risk attitude, as any decision about risk will be affected by the attitude of the person or organization making the decision. This is an important element in decision making which the systematic and scientific nature of risk management is designed to control.

If lower costs are considered an opportunity, the objective of risk management is to minimize risk subject to cost constraints, as there is generally a negative correlation between risk and cost. Cooke and Williams (2004) defined risk management as a continuos process by which the sources of uncertainties that could affect objectives are systematically identified, their impact scientifically assessed and their effects and likelihood managed to produce an acceptable balance between the risks and opportunities. This definition is with reference to the effects of uncertainty on objectives, which, for a construction company, could be at a corporate or project level.

PMI (2004) defines risk management as "the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project … in order to increase the probability and impact of positive events and decrease the probability and impact of negative events in the project".

This definition is adopted for this research because it is common in risk management literature; it considers both positive and negative aspects of risk; and it highlights the five core steps to manage risk formally which will be discussed later. From this definition and according to institute of risk management (2002), it is clear that risk management should be concerned with managing both threats and opportunities. Kähkönen (2001) supports this viewpoint by arguing that managing threats and opportunities should be integrated and the methods and models available have to be according to this principle. However, Olsson (2007) concludes that risk management cannot fully manage opportunities. He also stated that it is not easy to design a step approach to identify and realize opportunities unless a holistic view within the project is developed.

The figure 2.2 below shows the risk assessment procedure and illustrates the concept of residual risk, that is, those risks that have not been identified or that remain/persist following risk control measures

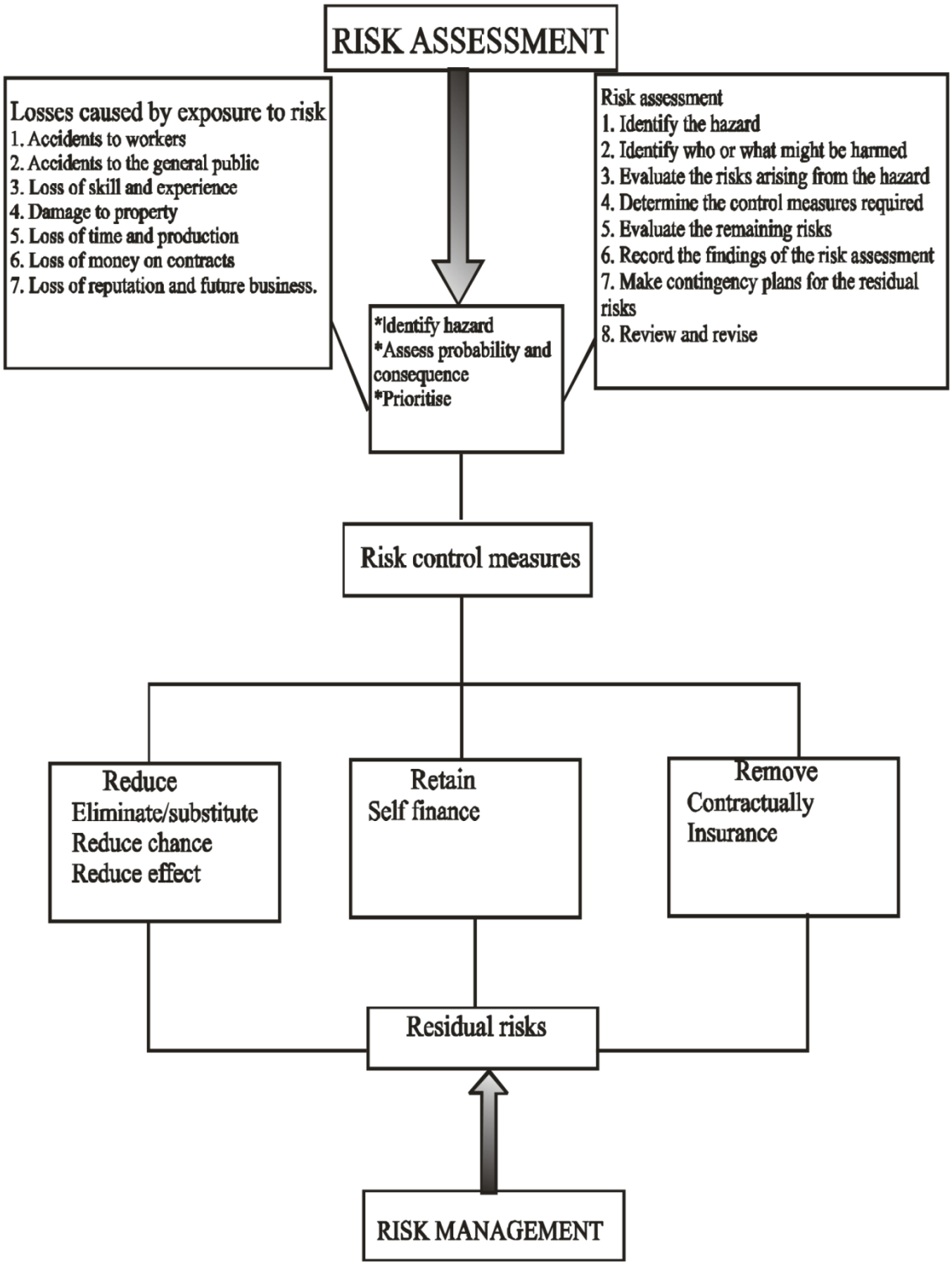


Figure 2.2 : Risk Assessment Procedure

Source: Cooke and Williams (2004)

2.1.5 Managing Risks in Construction Projects

This has been recognized as a very important management process in order to achieve the project objectives in terms of time, cost, quality, safety and environmental sustainability. Risk in construction has been the object of attention because of time and cost overruns associated with construction projects. Risk can be defined as an uncertain event or condition that if it occurs has a positive or negative effect on project objectives (Perry and Hayes 1985). According to Jaafari (2001), Risk can be defined as the exposure to loss, gain, or the probability of occurrence of loss/gain multiplied by its respective magnitude. Kartam (2001) as defined risk as the probability of occurrence of some uncertain, unpredictable and even undesirable events that would change prospects for the probability on a given investment. Risk can also be defined as the chance of something happening as a result of a hazard or threat which will impact on business activity or planned event. Risk can be regarded as anything that threatens the ability of a non-profit to accomplish its mission. Risk arises out of uncertainty. It is measured in terms of the likelihood of it happening and the consequences if it does happen.

Risk management is a discipline that enables people and organizations to cope with uncertainty by taking steps to protect its vital assets and resources. Risk management is the process which is used to avoid, reduce or control risks. There should be a balance between the cost of managing risk and the benefits expected from taking that risk.

The effective management of risks is a critical component of any winning management strategy. Properly designed risk management program allows an organization to actually take an additional risk while growing more securely. The option available for treatment of risks include: avoidance, reduction, contractual transfer, insurance transfer and retention. The most effective treatment of risk usually involves the application of more than one of these methods. Proper coordination of the selected methods of treatment is essential to effect real change and to accurately monitor results.

Yusuwan, Adnan and Omar (2008) in their study on Clients perspectives of risk management practice in Malaysian construction industry observed that Malaysian clients are slowly accepting risk management as a management tool that will help in managing a construction project effectively and successfully.

Abdul-Rahman et al (2015), in agreement with Yusuwan et al (2008) and Siang and Ali (2012) noted that construction projects in Malaysia mostly do not use risk management techniques, and only small group of construction professionals implement risk management in their projects. The reason for that is mainly due to lack of knowledge about the importance of risk management and its implementation in the construction industry amongst the members of a project team.

It is pertinent that construction professionals need to know how to balance the contingencies of risk with their specific contractual, financial, operational and organizational requirements. To achieve this balance, proper risk identification and risk analysis is required. The risk management process entails identifying construction risk and exposures, and formulating an effective risk management strategy to mitigate the potentials for loss.

2.1.6 Risk Assessment in Construction Projects

According to Deviprasadh (2007), risk assessment is the technique that aims to identify and estimate risks to personnel and property impacted upon by a project. Traditional risk assessment for construction projects has been synonymous with probabilistic analysis. Such approaches require events to be mutually exclusive, exhaustive and conditionally independent. However, construction involves many variables, and it is often difficult to determine causality, dependence and correlations. As a result, subjective analytical methods that rely on historical information and the experiences of individuals and companies have been used to assess the impact of construction risk and uncertainty.

2.1.7 Risk Management Framework

The managerial techniques used to identify, analyze and respond to risk have been applied in construction only during the last two decades Perry and Hayes (1995), Ward and Chapman 1995 & 1997, Perry (1986), Healy (1981) after reviewing various authors, developed one approach which is suitable for risk management in large projects. Wideman (1986) proposed a theoretical framework of a construction risk management model. Al-Bahar and Grandall (1990) based on Wideman's (1986) conceptual ideas converted the model into a completely defined, quantitative management model. Al-bahar and Grandall's model entitled Construction Risk Management System (CRMS) consists of the following four processes:

i. Risk identification ii.

Risk analysis and

evaluation iii. Risk

Management iv. System

Administration

The models particular emphasis is placed on how to identify and manage risks before, rather than after, they materialize into losses or claims. The CRMS has the features of a systematic framework of risk management which is methodical, objective and analytical has quantitative management, and is self-contained.

Risk management framework is sometimes called Risk management process (RMP) (Smith, 1995, Chapman and ward, 1997) and can be described in terms of phases (stages), which are decomposed, in a variety of ways. Some models are more detailed than others, but all shows similar characteristics as the model by Flanagan and Norman (1993) who has described a framework as shown in figure 2.3

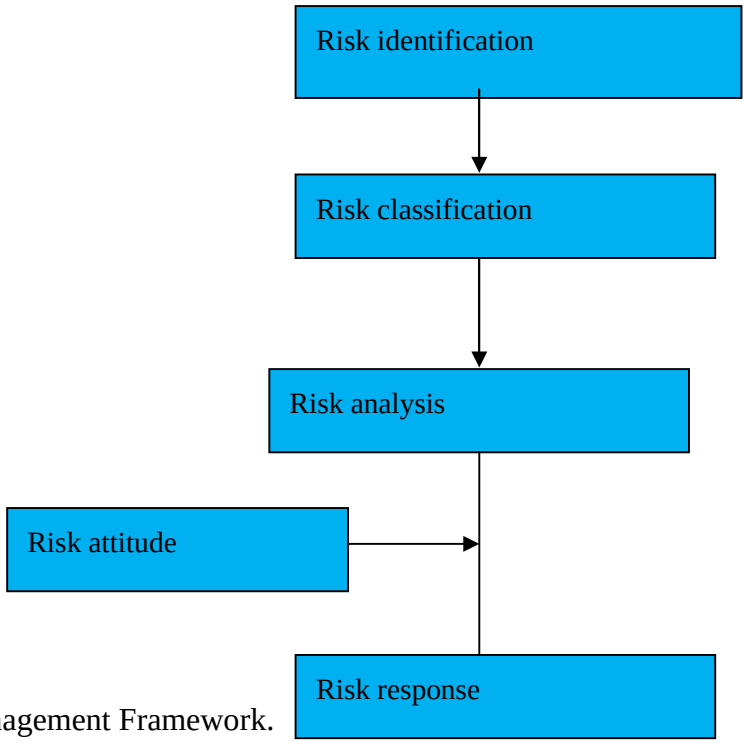


Figure 2.3: The Risk Management Framework.
Source: Flanagan and Norman (1993)

The risk management framework sometimes called the risk management cycle in engineering construction consists of four components.

2.1.7.1 Risk Identification

2.1.7.1 Risk Identification

Risk identification consists of determining which risks are likely to affect the project and documenting the characteristics of each. Risk identification is not a one-time event; it should be performed on a regular basis throughout the project. This should address both internal and external risks. Internal risks are things that the project team can control or influence, such as staff assignments and cost estimates. External risks are things beyond the control or influence of the project team, such as market shifts or government action. Risk involves only the possibility of suffering harm or loss. In the project context, however, risk identification is also concerned with opportunities (positive outcomes) as well as threats (negative outcomes).

In risk identification, a clear view of the event is the first requirement, focusing on the sources of risk and the effect of the event. One can do it in a structured and systematic way by distinguishing between controllable and uncontrollable risks, dependent and independent risks and total dependence or partial dependence. Alternatively, one can work with an experienced team to consider explicitly three separate areas. They are: risk internal to the project, risk external to the project and anticipation of sources of claims.

This stage of risk management is viewed by many as the most important, as the subsequent stages can only operate on the identified risks (Al-Bahar and Crandall, 1991). Clark, Pledger and

Needler (1990), go as far as to say "an identified risk is not a risk, it is a management problem". This suggests a difference between an identified risk and one which, although it exists but has not been identified.

The process of risk identification is defined by Al-Bahar and Crandall (1991), as the process of systematically and continuously identifying, categorizing, and assessing the initial significance of risks associated with a construction project. Although the initial assessment of significance of risks could be considered as a part of the analysis stage, it is placed here because of the need to limit the number of identified risks (Perry and Hayes, 1985, Berny and Townsend, 1993). In this way, pre-analysis can help to eliminate insignificant risks from the detailed analysis stage. Analysis can then be seen as a process of increasing complexity

and sophistication, initially viewing risk independently, secondly in connection with other risks, and finally in the context of possible strategies (Thring,1992).

2.1.7.2 Risk Identification Techniques

The process of risk identification relies on the knowledge, judgment and experience of the people involved in the project or business. In order to assist these people, and to add scientific base to the process, techniques have been developed. These techniques also help to control bias, arising from the subjective nature of the exercise and personal objectives.

The techniques can be divided into two categories, those designed to assist in the identification of risks and opportunities, and those designed to assist in determining the initial significance of those sources.

According to Garg (2005), risk can be identified by the following methods:

i. Brainstorming
ii. Workshops
iii. Interviews
iv. Questionnaire survey
v. Feedback from similar projects
vi. Use of specialists
vii. Previous experience

The techniques applied to the pre-analysis stage include the following:

1. Qualification
2. Quantification
3. Risk Mapping
4. Classification

Risk Qualification: The first stage of any analysis is risk measurement, in which the possible effects of the identified risks and their likelihood of occurring are assigned. There are two methods of achieving this, qualification and quantification (Franke, 1987).

Risks contain two parts, their impact and the probability of that impact; many definitions of risk are based on these characteristics. Qualification is used when the two parameters are described

using words. For example, the impact might be described as low, moderate or high, and the likelihood as probable, unlikely, etc. Words are used because of the difficulty in assigning actual values. Although such classifications are relatively easy to assign and their usefulness is limited.

Risk Quantification: In many cases, it is possible to evaluate the impact of a risk in terms of cost or time, as these have commonly used units. Quantities such as quality cannot readily be quantified due to lack of suitable units. In such cases, it is suggested that the effect is converted to an equivalent cost (Franke, 1987). However; in some cases this is not possible or advisable.

The quantification of the probability of the risk occurring is often a more subjective task than that of the impact or effect. Ideally, the probability would be derived statistically from historical data. Unfortunately, historical data is generally not available, or is too sparse to make a confident statistical prediction. Consequently, in many cases, a subjective assessment is made, based on the historical data available and the experience and judgment of the people involved.

Following the qualification or quantification of the risks, pre-analysis can be performed. The following list contains examples of the techniques used for this task:

i. Risk Mapping
ii. Risk Classification

Risk Mapping: This is perhaps the most common and simplest of the techniques. A risk map is a two dimensional graph, one axis representing the potential impact of a risk, and the other denoting the probability of occurrence. The graph is converted to a map by placing of contours

(or iso-risk curves), the contours further away from the origin denote high risk

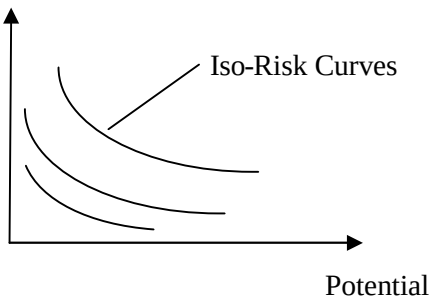


Figure 2.4: Risk Map
Source: Al-Bahar and Crandall,(1991)

The graph in Figure 2.4 shows the iso-risk curves, dividing the space into regions of equal risk.

The limitations of such a technique are that it is only applicable to event risks, that is, risks which either occur with a pre-defined effect, or do not, and that it does not acknowledge the

link between individual risk events, treating each as an independent event, both in terms of probability and effect.

Risk Classification: The three ways of classifying risk are by identifying the type, impact and consequence of risk. The types of risk in the construction industry can be classified as:

i. 'Pure' risk (no potential gain) ii.

Speculative' risk (possibility of loss or gain)

The impact of risk can be viewed in a risk hierarchy such as: environment, market/ industry, company and project/individual

The consequence of risk can also be classified into: maximum probable loss, most likely cost of the loss, likely cost of servicing the loss if no insurance has been effected, cost of insuring against the event occurring, and reliability of the prediction about the event.

As an extension of this, Williams (1994), proposes a risk register which, acting as a database, combines information regarding the effect each risk may have and its probability, any actions which can be taken to control the risk, and the contractual status of the risk, i.e. the extent to which the risk can be transferred.

Effectively, the risk register brings together the results of risk quantification, mapping, and classification. The benefits of this are that it produces a summary of the identified risks and allows the links between them to be identified (Al-Bahar and Crandall, 1991).

2.1.7.3 Risk Analysis

The essence of risk analysis is that it attempts to encompass all feasible options and to analyze the various outcomes of any decision. The use of risk analysis gives an insight into what happens if the project does not proceed according to plan. The risk analysis can be applied in the following steps:

1. All the various options should be considered
2. Consider the risk attitude of the decision maker
3. Consider what risks have been identified, which are controllable and what the impact is likely

to be.

4. Measure both quantitative and qualitative.
5. Interpretation of the results of the analysis and development of a strategy to deal with the risk.
6. Decide what risks, to retain and what risks to allocate to other parties.

Risk analysis involves assessing the identified risks. This first 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 use of risk analysis gives an insight into what happens if the project does not proceed according to plan. When active minds are applied to the best available data in a structured and systematic way, there will be a clearer vision of the risks than would have been achieved by intuition alone (Flanagan & Norman, 1993). Figure 2.5 below shows the sequence in risk analysis as detailed by Flanagan & Norman (1993)

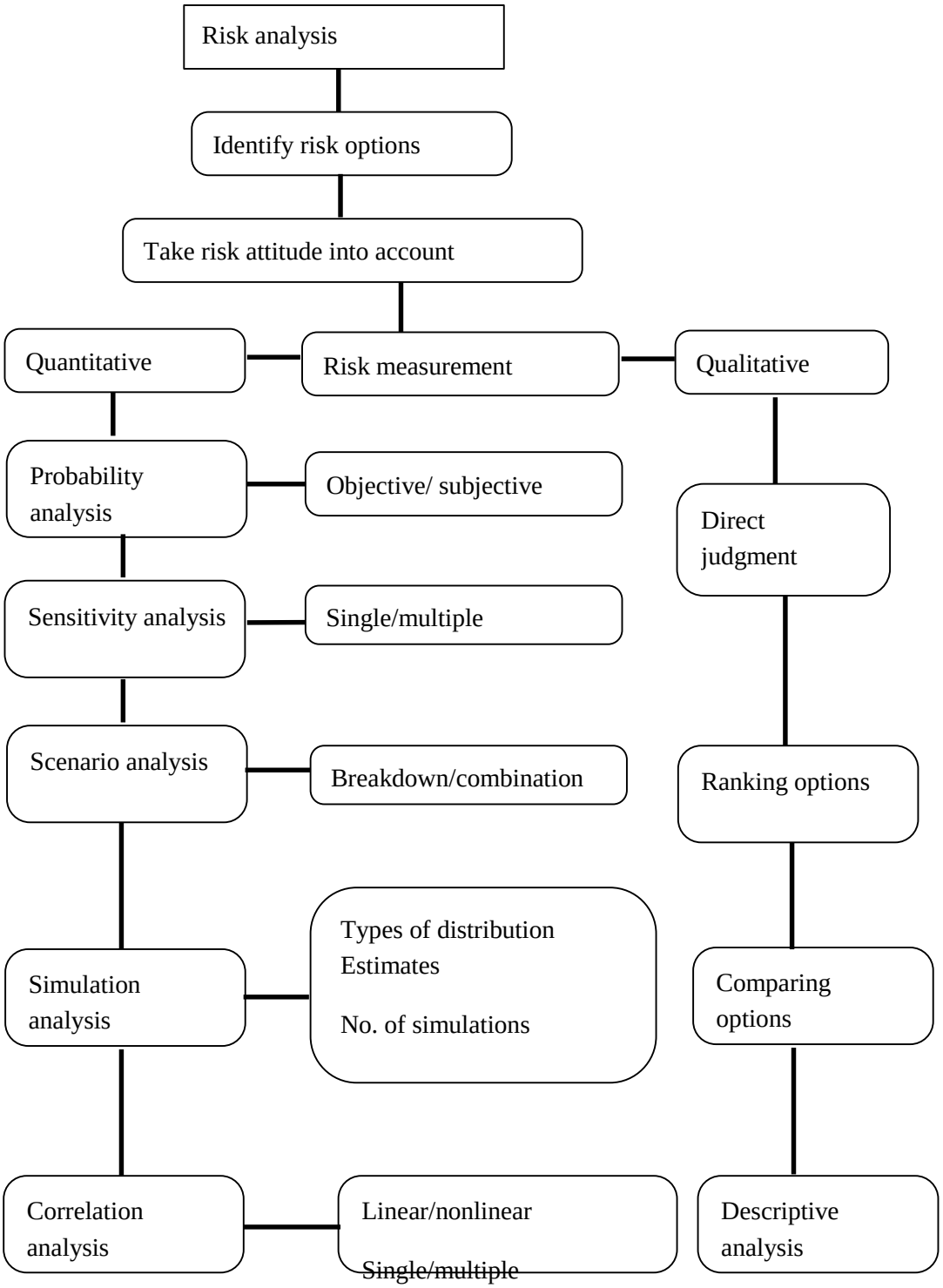


Figure 2.5: Risk Analysis Sequence (Flanagan & Norman, 1993)

Risk analysis must not be viewed as a stand-alone activity; any strategies developed must not be seen as cast in stone commandants. Rather, these should be seen as a component of all

decisions made continually to respond to project dynamics (Jaafari, 2001). Risk analysis involves evaluating risks and risk interactions to assess the range of possible project outcomes. It is complicated by a number of factors including, but not limited to opportunities and threats (PMI, 1996).

Opportunities and threats can interact in unanticipated ways (e.g. schedule delays may force considerations of new strategy that reduces overall project duration).

A single risk event can cause multiple effects, as when late delivery of a key material produces cost overruns, schedule delays, penalty payments, and a lower quality product and reliability.

What is needed is an application of risk analysis to help project managers control cost that is relatively simple to apply, can be used throughout the life cycle of a construction project, accounts for the tendency of construction professionals to apply risk in linguistic terms, and apply their experience (Bender & Ayyub, 2001).

Also, the importance of risk analysis is stressed by Al-Bahar and Crandall (1991), by describing it as "the link between systematic identification and rational management of significant [risks]." They go on to define it as a "process which incorporates uncertainty in a quantitative manner, using probability theory to evaluate the potential impact of risk". Other authors, namely Perry and Hayes (1985), agree that the objective of risk analysis is to determine the combined effect of the identified sources of risk and opportunity and highlight those which make a significant contribution to that total. Bannister and Bawcutt (1981) opined that risks are taken depending on "the size of the potential losses, in excess of gains over losses, and in the favorableness of the odds". This illustrates again that risks are accepted because of the opportunities they bring, based on the balance between the two.

In this study, risk analysis will be defined as the process of evaluating the balance which exist between the risks and the opportunities, and identifying the sources to which that balance is sensitive. The balance between the risks and opportunities is the parameter against which decisions are made and as such it should be an output of the analysis stage. Further, in order to facilitate effective management action, the significance of individual sources of risk and opportunity is required.

The techniques employed in risk analysis can be categorized as those designed to determine the balance between the risks and opportunities, and those which aim to assess the significant of individual risks

2.1.7.4 Methods of Risk Analysis

The analysis of risks can be quantitative or qualitative in nature depending on the amount of information available (APM, 2000). Qualitative analysis involves identification together with assessment of risk, and quantitative analysis focuses on the evaluation of risk (Chapman, 2001).

Table 2.1 below shows the summary of the various techniques used for risk analysis.

Table 2.1: Various risk analysis techniques, adapted from Ward and Chapman (1997).

Table 2.1: Risk Analysis Techniques

Qualitative	Quantitative
Direct judgment	Probability analysis
Ranking options	Sensitive analysis
Comparing options	Scenario analysis
Descriptive analysis	Simulation analysis

2.1.7.5 Quantitative Risk Analysis

Quantitative risk analysis is a way of numerically estimating the probability that a project will meet its cost and time objectives. Quantitative analysis is based on a simultaneous evaluation of the impact of all identified and quantified risks. The result is a probability distribution of the project's cost and completion date based on the risks in the project (Office of Project Management process Improvement, 2003). The quantitative methods rely on the probability distribution of risks and may give more objective results than the qualitative methods, if sufficient current data is available. On the other hand, qualitative methods depend

on the personal judgment and past experiences of the analyst and the results may vary from person to person. Hence, the quantitative methods are preferred by most analysts (Ahmed et al, 2001). Quantitative risk analysis considers the range of possible values for key variables, and the probability with which they may occur. Simultaneous and random variation within these ranges lead to a combined probability that the project will be unacceptable (Asian Development Bank, 2002). Quantitative risk analysis involves statically techniques that are most easily used with specialized software (Office of Project Management Process improvement, 2003). Quantitative risk analysis is to assign probabilities or likelihood to the various factors and a value for the impact, then identify severity for each factor (Abu Rizk, 2000). When thorough quantitative risk analysis is necessary it can take two alternative approaches (Kuismanen, 2001):

Risks can be quantified as individual entities while looking at the big picture. This can include the cumulative effects (to certain accuracy) into each individual risk and thus make more accurate estimations of the net value of the risks.

Alternatively, modeling the mathematical properties of the interrelations from the bottom up can be started and then calculate the net impact of each risk including the effects of interrelations.

2.1.7.6 Methods of Quantitative Risk Analysis

For any specific risk analysis technique, it requires a strategy. It is best to begin by providing a way of thinking about risk analysis that is applicable to any specific tool that might be used.

i. Probability Analysis: is a tool in investigating problems which do not have a single value solution. Monte Carlo Simulation is the most easily used form of probability analysis.

ii. Monte Carlo simulation is presented as the technique of primary interest because it is the tool that is used most often.

iii. Sensitivity Analysis is a tool that has been used to a great extent by most risk analysts at one time to another.

iv. Breakeven Analysis is an application of a sensitivity analysis. It can be used to measure the key variables which show a project to be attractive or unattractive.

v. Scenario Analysis is a rather grand name for another derivative of sensitive analysis technique which tests alternative scenarios, the aim is to consider various scenarios as options.

2.1.7.7 Qualitative Risk Analysis

According to Lowe (2002), qualitative risk assessment involves the identification of a hierarchy of risks, their scope, factors that cause them to occur and potential dependencies. The hierarchy is based on the probability of the event and the impact on the project. In qualitative risk analysis, risk management acts as a means to register the properties of each risk (Kuisimanen et al, 2002). Qualitative risk analysis assesses the importance of the identified risks and develops prioritized lists of these risks for further analysis or direct mitigation. The management team assesses each identified risk for its probability of occurring and its impact on project objectives. Components of risk analysis were introduced by Kindinger and Darby (2000):

1. List activities, tasks, or elements that make up the project

2. Identify applicable risk factors

3. Develop risk-ranking scale for each risk factor.

4. Rank risk for each risk activity

5. Document the results and identify potential risk reduction actions.

2.2 Theoretical Review

2.2.1 Theoretical Framework

The theoretical framework upon which this work is founded is that of cause- effect Analysis Theory. The theory is explained using cause- effect relationship. The relationship between cause and effect takes a logical pattern since if there exists an effect, then there must be a

corresponding cause or causes and vice versa. This theory was used because for a building to collapse there must be a causative factor or factors and resultant effects. The Construction Management theory was also discussed and these provide the theoretical framework for analyzing the building collapse risks under study.

2.2.2 The Cause- Effect Analysis Theory

The cause and effect relationship can be analyzed using cause and effect model invented by Professor Kaoru Ishikawa in the 1943 to help explain to a group of engineers at Kawasaki steel works on how a complex set of factors could be related to help understand and solve a problem (Ishikawa, 1990). It was also applied as quality management technique in the 1960s. The technique was later published in 1990 in Ishikawa's book titled "Introduction to Quality Control". The technique uses a diagram-based approach for thinking through all of the possible causes of a problem. This helps in carrying out a thorough analysis of the situation.

The model is popularly known as "Ishikawa diagram" or "Fishbone diagram". This is because a completed diagram can look like the skeleton of a fish.

The technique can be applied to the following in other fields of knowledge.

i. To discover the root cause of a problem
ii. To uncover bottlenecks in a process
iii. To discover where and why a process is not working.

2.2.2.1 Explanation and Application of the Technique

Fishbone diagram is a graphical technique used to identify and arrange the causes of an event, problem or outcome. It graphically shows the hierarchical relationship between the causes of a problem according to their level of importance including the outcome (effects). The technique uses a model which makes use of four steps, (Ishikawa, 1990) as follows;

1. Identify the problem
2. Work out the major factors involve
3. Identify the possible causes and effects
4. Analyze your diagram.

Step 1: Identify the Problem

The technique firstly identifies the problem (effect) including when and where it occurs. Thereafter a box is drawn on one side of a large sheet of paper and a line is drawn across the paper horizontally from the box as shown below.

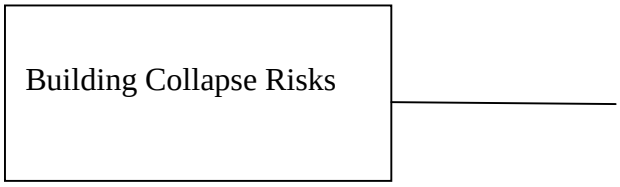


Fig 2.6: Diagram illustrating the head (X) and spine of a fish

This diagram that looks like the head and spine of a fish gives space for the development of other structures, signifying ideas. The problem (building collapse risks) represented by (X) has been identified and written in the box.

Step 2 Work Out the Major Factors Involved.

The second step looks for the major factors that could be the likely cause(s) and effect(s) of the problem. Thereafter lines are drawn from the "Spine of the fish". Each line represents a major factor and is labeled accordingly as shown below.

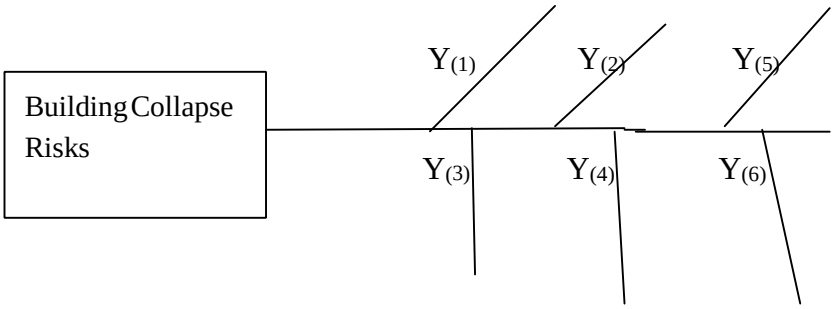


Fig 2.7: Diagram illustrating the head(X), spine and large bones which are developed from the spine of a fish.

This arrangement which looks like the "large bones" of a fish gives space for the development of more structures which signifies more ideas. The lines labeled Y_1, Y_2, and Y_3 represent the six major categories of factors that could give rise to building collapse risks as was found in literature. They are;

1. Economic/Financial Risks (Y_1)
2. Socio-Political Risks (Y_2)
3. Human Related Risks (Y_3)
4. Environmental risks (Y_4)
5. Physical Risks (Y_5)
6. Law/Legal Risks (Y_6)

Step 3: Identify the Possible Causes

The third step is to identify the possible effects of building collapse risks related to each of the factors listed above. Thereafter minor or small lines are drawn from the major lines (Large fish bones) of the diagram. Each small line represents a possible cause of the problem and is labeled accordingly as shown below:

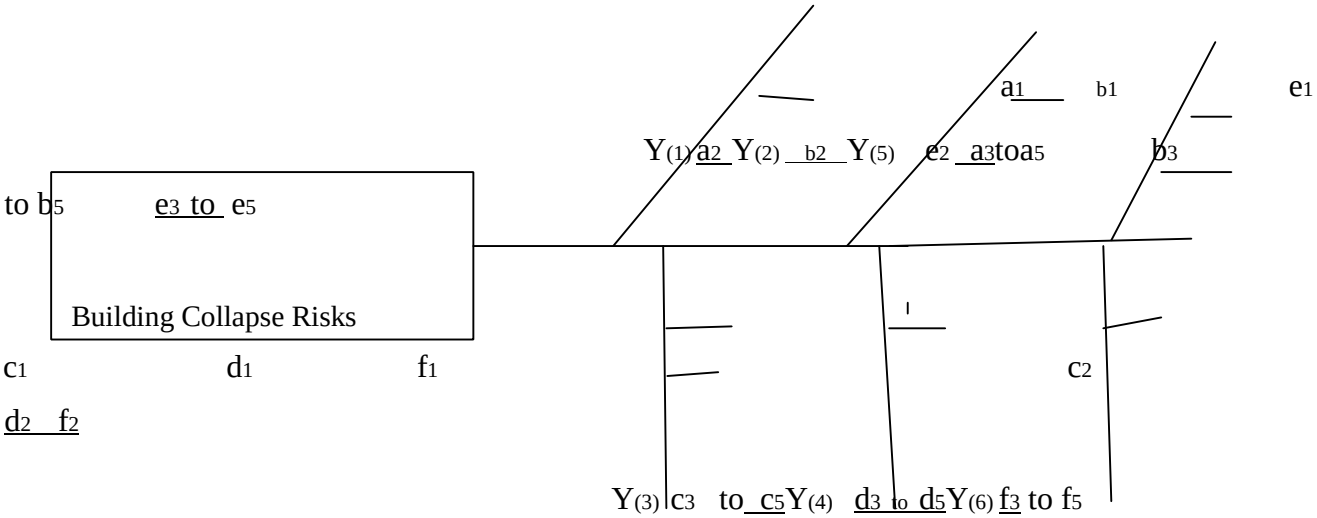


Fig 2.8: Diagram illustrating a complete skeleton of a fish bone

This arrangement which looks like the "small bones' of a fish gives a comprehensive view or idea of the diagram which is the skeleton of the fish. The lines labeled; a_1 to a_5, b_1 to b_5, c_1 to c_5, d_1 to d_5, e_1 to e_5 andf_1 to f_5 represent other possible effects of building collapse risks that impact in the Nigerian economy, which are attributed to and categorized as Economic/Financial risks (Y_1), Socio-Political risks (Y_2), Human Related risks (Y_3), Environmental risks (Y_4), Physical risks (Y_5) and Law/Legal risks (Y_6).

Step 4: Analyze Your Diagram

This final step is the analysis of the diagram. At this step all the possible causes or effects of the problem one can think of must have been shown in the diagram. This stage investigates the most likely cause(s) and effect(s). It involves setting up investigations, carrying out surveys, collecting and analyzing data to ascertain which of the possible effects actually led to the problem. This analysis will also help to ascertain whether two or more possible effects combined together or jointly led to the problem.

In figure 2.4, the box marked (X) together with the two long horizontal lines attached to it is the head and spine of a fish and it represents the problem of the study which is the effect of building collapse risks in the Nigerian economy. The major lines labeled Y_1, Y_2, Y_3, Y_4, Y_5, and Y_6 represent the major categories of building collapse risks that affect the Nigerian built environment. They include Economic/Financial risks (Y_1), Socio-Political risks (Y_2), Human related (Y_3), Environmental risks (Y_4), Physical risks (Y_5) and Law/Legal risks... The minor (small) lines labeled a_1 to a_5, b_1 to b_5, c_1 to c_5, d_1 to d_5, e_1 to e_5, and f_1 to f_5 are the minor or small bones of a fish which are developed from the major (large) bones of a fish. These minor lines represent the possible effects of building collapse risks. The minor lines labeled; a_1 to a_5 represent the possible effects of building collapse classified as Economic/Financial risks. They include; Loss of property, Loss of annual income/capital investment, Loss of materials, Bankruptcy of investor/developer, Decrease in the real estate sector to the nation's Gross Domestic Product (GDP), among others. The minor lines labeled b_1 to b_5 represent the possible effects of building collapses classified as Socio-Political risks. They include; Loss of trust, Loss of jobs, Scarcity of property, Loss of reputation and integrity of the contractors, Withdrawal of practicing licenses, among others. The minor lines labeled; c_1 to c_5, represent the possible effects of building collapse risks classified as Human related risks. They include; Loss of lives, Injuries,

Loss of contributions from the victims towards the socio-economic growth of the nation,

Increase in the death rate against the United Nation Millennium Development Goals (MDGs),

Leads victims to permanent disability, etc. The minor lines labeled d_1 to d_5 represent Environmental risks. These are: Provides hideouts for robbers or hoodlums, Place of abode for dangerous animals like snakes, Environmental damage, Loss of building aesthetics, Degrading of the environment, among others. The minor lines labeled e_1 to e_5 represent Physical risks. These include: Structural damage, Damage to contents, Temporary relocation, Loss of the strength of the building, Loss of functionality, etc. The minor lines labeled f_1 to f_5 represent Law/Legal risks. They include the following: Exasperation of crises among the stakeholders, Legal tussle among the stakeholders, Arbitration/Mediation to resolve crises arising from building collapse, Conflicts resolution, Apportioning blames and arbitrary words of mouth among the stakeholders, among others.

The diagram in fig 2.4 shows that building collapse risks (X) occur as a result of one or a combination of two or more possible effects (a_1 to a_5, b_1 to b_5, c_1 to c_3, d_1 to d_5, e_1 to e_5, f_1 to f_5) which belongs to either one or more of the categories of factors that cause building collapse risks

(Y_1, Y_2, Y_3, Y_4, Y_5 and Y_6).

The fishbone diagram illustrates that a relationship exist between cause and effect. Buildings are constructed to serve as shelter for man, his properties and other activities. Therefore, they must be properly planned, designed and erected to obtain desired satisfaction from the environment. There is the need to identify the building collapse risk factors and remediation measures in order to reduce the effects of building collapse in Nigeria, increase general economic development of Nigeria and building industry in particular.

2.2.3 Systems Theory

System theory is a concept that originated from biology, economics and engineering, which explores principles and laws that can be generalized across various systems (Yoon and Kuchinke, 2005; Alter, 2007; Dubrovsky, 2004). It is an interdisciplinary theory about every system in nature, in society and in many scientific domains as well as a framework with which we can investigate phenomena from a holistic approach (Capra, 1997).

A system is a set of two or more elements where: the behavior of each element has an effect on the behavior of the whole; the behavior of the elements and their effects of the whole are interdependent; and while subgroups of the elements all have an effect on the behavior of the whole, none has an independent effect on it (Skyttner, 1996). In other words, a system comprises of subsystems whose inter-relationships and interdependence move towards equilibrium within the larger system (Martinelli, 2001, Steele, 2003).

The three major pioneers are Kenneth Boulding, Daniel Katz and Robert Kahn. Boulding arranged systems in a hierarchy of complexity (Marttinelli, 2001; Bausch, 2002). His general framework can be applied to managerial systems but keeping in mind that any level incorporates characteristics from all the previous levels. Daniel Katz and Robert Kahn collaboratively viewed organizations as comprising of patterns of behavioral events. These patterns are interdependent, cyclical, and consistent over time, and must be understood in terms of their interaction with each other, and with the external environment. They were the first to introduce the concept of inputthroughput-out in describing organizational environments (Capps & Hazen, 2002).Since this theory considers the input- throughput-out component and their interactions both within themselves and with the external environment, the elements of purpose, people, structure, techniques and information must be coordinated and integrated by the managerial system, in order to maximize value for the organization. System theory can be focused on knowledge, value, quality, environment, relationships, adaptation, and complexity in other to be applied in management and construction.

An open system consists of three essential elements. An organization receives resources such as equipment, natural resources and the work of employees, referred to as inputs. The inputs are transformed called throughputs and then yield product and services called outputs. Outputs are realized to the environment. Feedback loops are also an important feature of the open system. They provide information to the organization by connecting the output to the input. A negative feedback loop indicates that there is a problem that should be corrected. For example the failure of a product design indicated by the need to recall the product. A positive loophole can identify the output that has worked well. For example, a successful marketing company that yield high sales.

Systems theory also enables us to understand the components and dynamics of client systems in order to interpret problems and develop balanced intervention strategies, with the goal of enhancing the goodness of fit between individuals and their environment. Systems theory does not specify particular theoretical frameworks for understanding problems, and it does

not direct the social worker to specific intervention strategies. Rather, it serves as an organizing conceptual framework or meta-theory for understanding (Meyer, 1983).

Von Bertalanffy (1901 – 19072) was the originator of systems theory used in social work, a theoretical biologist born and educated in Austria.

The figure 2.9 depicts the nature of the system. There are inputs, outputs and outcomes. However, what happens in the system is somewhat mysterious, and one can only measure the changes by observing the outputs in relationship to the outcomes or goals of the system. Workers can vary or modify the inputs, including their own actions, to create a change within the system.

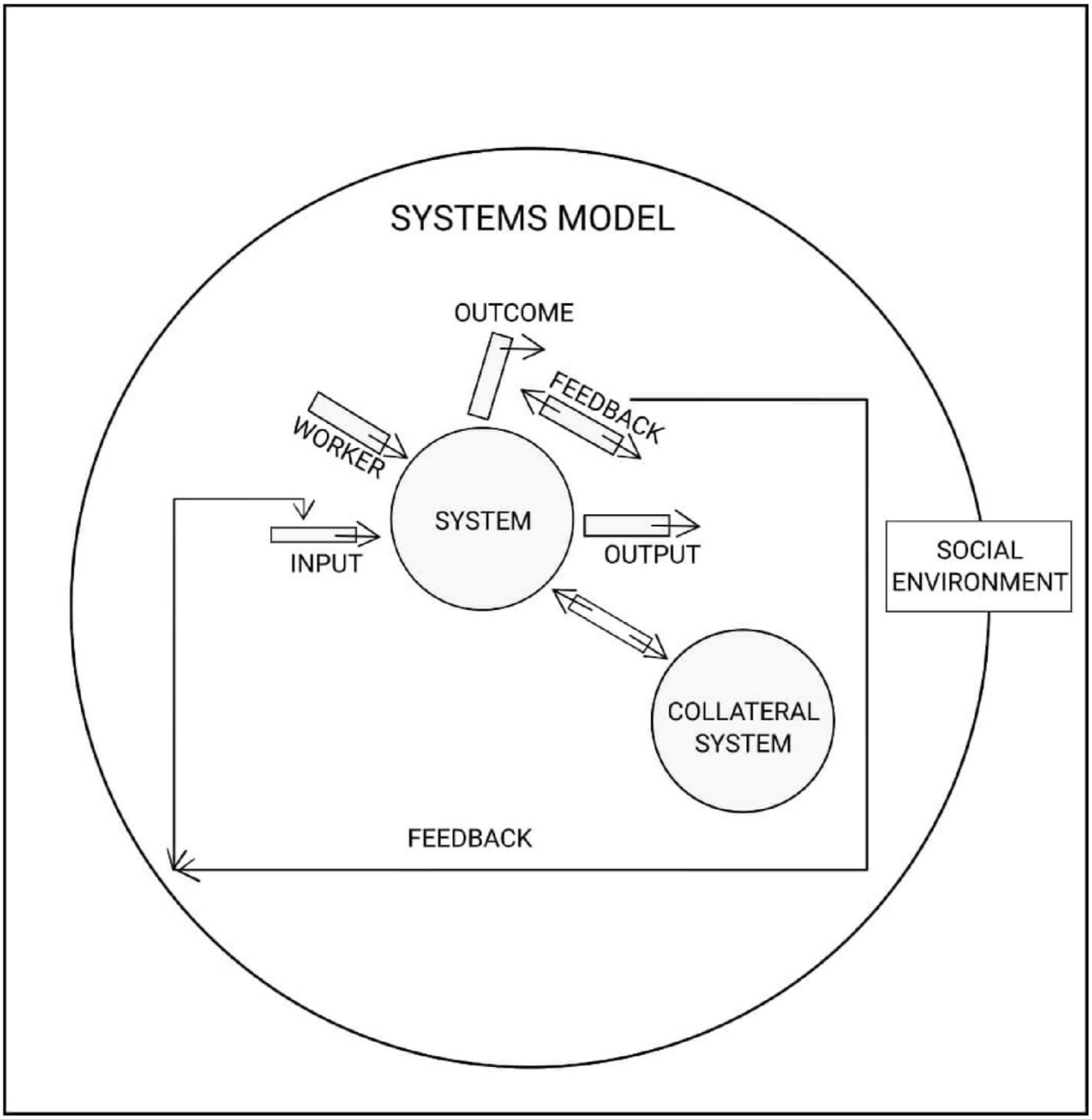


Figure 2.9: System Model

Source: System Theory by Bruce D. Friedman and Karen Neuman Allen

Durkheim (1984) explained that in highly organized systems, the division of labour contributes to the maintenance of societies. In complex societies, individuals perform various roles that, while they lead to specialization and segmentation, also create a high degree of mutual

interdependence between units. Although the individuals performing them will change, these roles persist over time and maintain a society (Durkheim, 1984).

In the figure 2.9, Durkheim's concept of "anomie" helps to explain where a system exists within a social environment affect the system and its outcomes and outputs. The system also interfaces with other systems or collateral systems. There are expectations on the role and function of the system to conform to standards within the larger social environment. If the system does not subscribe to those norms, then the system is considered dysfunctional. Therefore, this theory could be applied in the handling the menace of building collapse and the impact of the associated risks in the Nigerian economy.

2.2.4 Goal Theory

The development of goal theory is linked with Weber and Roberts Michels int their separate works on bureaucracy. However, the theory was popularized by Talcott Parsons by elevating goals of organizations to central position as raison d'être of all organization (Okoli and Okoli, 1990). This theory states that all organizational activities are oriented and directed toward the achievement of set goals. Goals are regarded as value premises, which serve as the inputs to decisions. Goals are essential elements of organization. To be effective, an organization must clearly spell out its goals, objectives and strategies (Mullins 1996). The theory possesses several appealing values and one of them is that, it provides the basis for standard performance and for passing judgment on the effectiveness of organization (Ikelegbe and Osumah, 2007). It also provides guidelines for decision-making and justification for actions taken. It helps also to develop commitment of individuals and groups to the activities of the organization. As a result attention is directed on purposeful behaviour and basis for motivation and reward systems. It is the basis for objectives and policies of the organization.

Goal theory gives indication of what the organization is really like, its true nature and character both for members and for people outside the organization (Mullins, 1996). According to Agagu (2010), goals must clearly be defined in order to stimulate and enhance performance. He then added the characteristics and importance of a goal, and they are:

Goals narrow attention and direct efforts to goals relevant activities, and away from perceived undesirable and goal-irrelevant actions.

Goals can lead to more effort. This propels a worker to work more intensely to attain benchmark especially when incentives, promotion or even deadline are attached to such attainment.
Goals influences persistence in that one is inclined to work through set backs or work harder if pursuing a goal.
The flaws of goal theory include: The goal theory is a stereotyped and straight-jacketed framework. It pays little or no attention to the ecology at which an organization operates which directly and indirectly impinges on the operation, effectiveness and outputs of such organization. Also, it pays little attention to the impact of unforeseen contingences, and bureaucratic bottlenecks. Nevertheless, , the theory is suitable to analyze and assess the performance of Disaster Management Agencies such as NEMA, SEMA, LEMA, Nigeria Fire Brigade, etc.

2.2.5 Theory of Construction Management

The theory was propounded by Radosavljevic and John Bennett's (2010). The authors aim is to provide a "rigorous theory" based on a "tool kit of concepts and relationships" that will improve the efficiency and quality of "construction products". The distinction between the conventional approach of construction management (CM), where contractors deliver projects and the idea of companies producing a product is an important element in the thinking behind the theory proposed here. A related aim of the book is therefore to raise the view point of construction management from projects to the companies that manage projects. Their intention identifies and defines the concepts needed to understand construction management. Radosavljevie and Bennett somewhat self-consciously developed theory without drawing on general management theories, rather wanting to base their ideas on construction industry projects and practice, which makes their definitions extremely important to their theory of CM and to our understanding of that theory. The concepts are construction products and processes, organizations, interactions and relationships, and learning and performance. The main factors are communication, feedback lops, and how well established relationships are (called internal) or not (called boundary relationships). The definition of CM is "taking responsibility for the performance of a construction organization", measured by efficiency, which is "inversely related to the waste caused by complexity and external interference which prevent organizations from achieving their agreed objectives".

These concepts and definitions are important in the exploration of the theory of CM which is the core of the book. Through a series of propositions about construction management, CM teams (task groups) and related efficiency conditions they built a detailed description of construction organizations, processes and management. This results in "the basic concepts used in the theory of CM in mathematical terms to provide effective measures of features of construction which have a crucial impact on CM decisions". These are the six inherent difficulty indicators (IDIs), which are the fundamental variables in the theory of CM and are used to determine the most appropriate CM strategy. These IDIs are as follows:

1. Established relationships – consequential relationships between interacting teams that existed before the project started.
2. Relationship fluctuation – differences between times during the project with and without established relationships between teams.
3. Relationship quality – Time teams have spent previously working together
4. Relationship configuration – the pattern of team interactions over the project (this quite complex indicator because it can vary greatly over time, i.e. during a project).
5. Performance variability – team performance may not be consistent between projects
6. External interference - factors outside the control of the project managers.

Project size is measured in the number of team days , because "CM is concerned with the selection and organization of teams". This results in a set of five size groups, from minor (100 team days) to normal (5,000 team days) to mega (25,000 team days). The theory then guides the choice of CM strategy for that project. Here CM strategy is the approach used to deliver the project, and the five "major CM approaches currently used in practice" are:

1. Traditional construction – includes the UK's developed traditional construction" or architect led version, and the US (specialist contractor design) and European (architect and engineers design) versions:
2. Design builds – a single point of responsibility for delivery of the project
3. Management approaches – design and management teams working under the general direction of the team.
4. Partnering – concentrates on establishing effective relationships rather than roles and responsibilities, and can be a strategic or ongoing relationship.

5. Total construction service – industrialized building modeled on car manufacturers with an emphasis on reliability, quality and continuous improvement.

Those familiar with John Bennett's work over the last couple of decades will not be surprised that the Japanese construction industry features in the discussion of total construction service. The Big Five contractors and the industrialized home builders are held up as prime examples of what total service is and how it is delivered. To illustrate theory, they use an interesting case study of a large Family-run German building company. They clearly believe this is the future of the industry, and their theory not surprisingly supports that view.

Each of the CM approaches is described and discussed in some detail, and a hypothetical project is analyzed to quantify the six IDIs, and from these values get a forecast (prediction of the project's likelihood of successful completion. These discussions demonstrate the application of the theory and the use of the IDIs. Whether all this is a theory in the scientific sense of predictive value can be argued about. If data were gathered on a number of projects, and as the sample increases, the ability of the models six variables (the IDIs) to predict the "probability of project completion as planned" will become apparent. This theory relates to the present work in the sense that if there is a good organization and relationship between the workers and construction management there will be a very good product by the workers which prevents building collapse and reduce or eliminate the associated risks.

2.2.6 Overview of the Construction Industry

The construction in both developed and developing countries may be viewed as a sector of the economy which through planning, design, construction, maintenance and repair, and operation, transforms various resources into constructed facilities (Isa, Jimoh and Achuenu, 2013). The types of public and private facilities produced range from residential and non-residential buildings to heavy construction such as highways, bridges, railway tracks, airports, dams, power stations etc. These physical facilities play a critical and highly visible role in the process of economic development (Kheni, Gibb and Dainty, 2008). The major participants in the construction industry include the architects, builders, engineers, management consultants, general contractors, heavy construction contractors, special trade contractors or subcontractors, and construction workers, along with the owners, operators and users of constructed facility. Building finance and insurance agencies, land developers, real estate brokers, and material and equipment suppliers and manufacturers, among others,

are also involved in construction but are generally considered a distinct from but ancillary to the construction industry. The government interacts with the industry as purchaser, financier, regulator and adjudicator.

The industry plays a major role in economic development in the less industrialized nations since it constitutes a significant portion of both gross national product and employment. Indeed, the creation of physical facilities constitutes more than one-half of the gross domestic investment of both developed and developing nations. The industry also plays a key role in satisfying a wide range of physical, economic and social needs and contributes significantly to the fulfillment of various major national goals. The industry's size, the nature of its operation, and its presence in every developmental activity make it an attractive area for the transfer, adaptation and development of technologies consistent with the developmental goals of emerging nations.

The planning issues facing the development of the construction industry include:

The availability of local planning capabilities and the nature of the information base necessary for a sound planning analysis.

The financing of the construction project, the various bilateral and multilateral aid and loan sources and their availability, and the constraints each imposes on the construction process.

2.2.7 CONSTRUCTION INDUSTRY'S ENVIRONMENT

The regulatory environment within which the construction industry operates in developed countries is extensive and includes building and related codes, zoning ordinances, subdivision regulations, safety legislation, monetary fiscal policies, tax laws, financial institutions operating rules, and wage regulations. Similar regulations are emerging in developing countries and need to be expanded, but this must be done with regard for the local conditions of the particular country, and regulations must not simply be transferred intact from the industrialized nations, as has often occurred in the past.

2.2.7 Current Trends

Construction industry trends all over the world show a rise in its rate of growth. This industry is composed of many components including construction of heavy and civil engineering (highways, bridges, railway tracks, dams, airports etc), real estate (both residential as well as commercial) development, and specialized construction products (such as architectural products, electrical

connections, decorative items etc.). All these segments cannot be expected to show similar trends and in fact are showing differential growth pattern all over the world (Hoover, 2010). The construction industry contributes a huge chunk to the world Gross Domestic Product (GDP) amounting to $1/10^{th}$ of the same (Hoover, 2010). This industry has immense potential in generating huge amount of employment. It has been found out that construction industry offers employment to around 7% of the total employed workforce around the globe (Hoover, 2010). Construction industry is the largest sector in respect of consumption of energy. It consumes around $2/5^{th}$ of the consumed energy throughout the world. Resource utilization in case of construction industry amounts to half of the total resource used all over the world.

The most significant aspect associated with the construction industry trends is increased use of the latest IT technologies for pacing up the work. Cutting edge technology is being adopted by world's one of the biggest industries for leveraging purposes and is mainly being used in raising the efficiency level of engineering and designing of construction industry. It has been found out that the paper oriented format of operation in the construction industry is not at all a cost effective approach because it eats around sixteen billion US dollars in US real estate sector only (Hoover, 2010).Construction industry trends show that the utilization of information technology has helped the industry to save a lot of fund which could be channelized in more fruitful directions.

In United Kingdom (UK), a study by UK Construction (2013) identified a number factors which determine successful delivery of construction projects which include: equitable financial arrangements and certainty of payment, early contractor arrangement and continuing involvement of supply chain in design development, strong relations and collaboration with suppliers, capacity for effective site management including the ability to respond to change flexibly. One of the key findings of the research is that the industry has a low awareness of the sources of waste and duplication that are embedded in current construction practice.

Across the globe, the construction sector has been hit hard since the economic and financial crisis of 2008 and has been in decline in many developed economies. Despite this, the UK construction contracting industry remains one of the largest in Europe, measured by employment, number of enterprises, and gross value added (UKCES, 2012).

One of the latest technologies used in construction industry is Building Information Modeling (BIM). The technology helps all the factors of a project to work in a collaborative and concerted manner solely based on the platform of information technology. BIM helps the different members

of a project to communicate information among themselves which consequently leverages the productivity and at the same time minimizes the error along with cost.

2.2.8 The Nigerian Construction Industry

The size of the Nigerian construction industry is relatively small compared to the global construction industry. The industry is relatively underdeveloped and it accounts for about 2 percent of the Gross Domestic Product (GDP). This compares poorly with South Africa with 5.1 percent contribution to her GDP (Statistics South Africa 2002, CIDB 2004, Shakantu 2004 & Okolie 2011). Despite this, the industry has been growing rapidly at about 12 percent per annum; much faster than 2.5 percent growth rate for the GDP (GEMS 2010). This was evident in the report of the performance of this, where building and construction recorded the growth rate of 11.82%. The figure 2.10 below shows the sector statistics for the growth rate of the major economic drivers and their percentage growth rate.

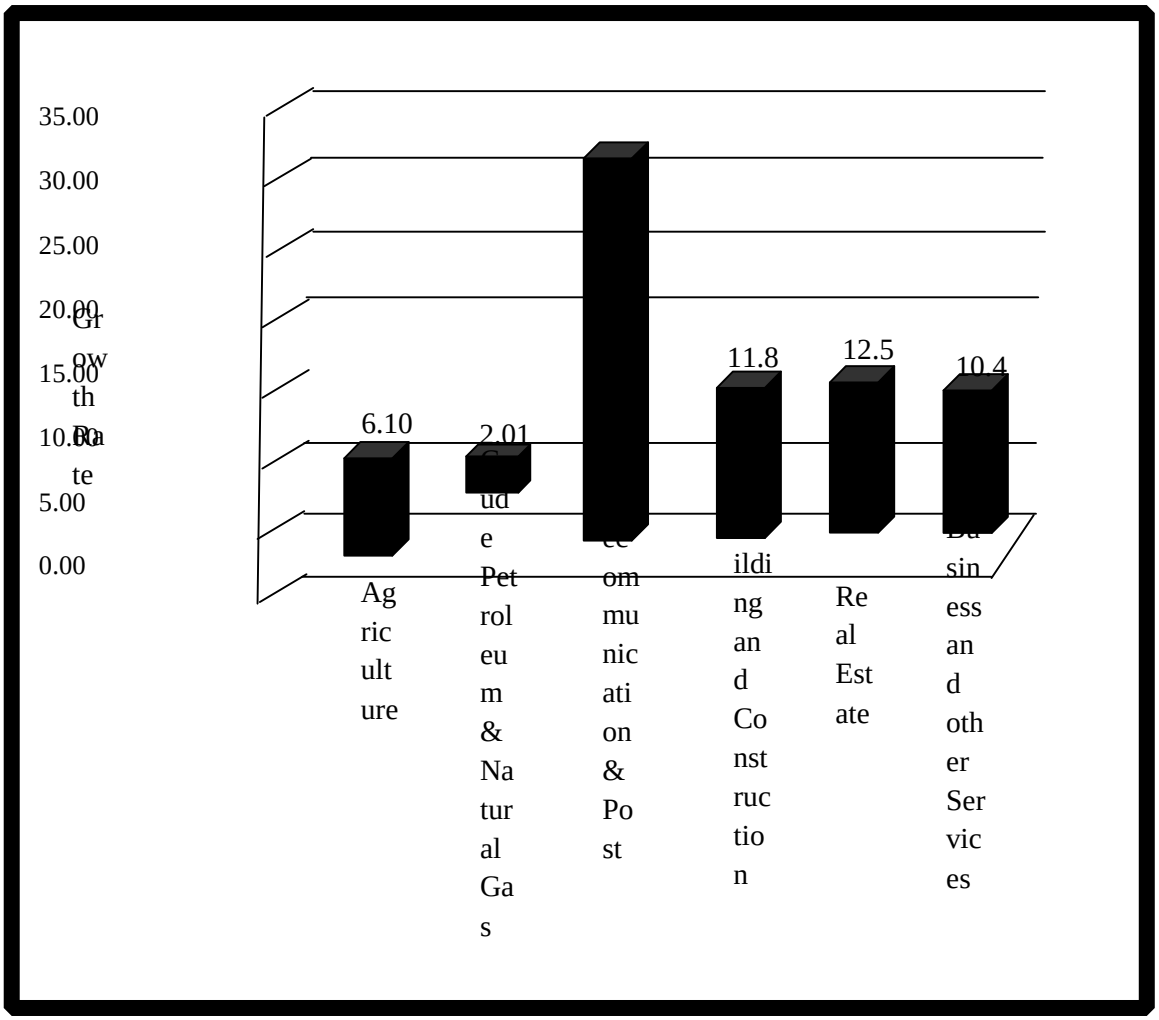


Figure 2.10: Drivers of the economy by second quarter of 2009.

Source: NBS 2009 as cited by Okolie 2011.

The construction industry in Nigeria plays an important role in facilitating the provision of facilities such as transport, water, electricity, education, housing and health (Okolie, 2011). Therefore, the construction industry is considered by some economists as a leading driver of economic development in a country. This is basically due to the fact that almost all other sectors of the economy in one way or another depend solely on the products and services of the construction industry in order to carry out their operations.

The Nigerian construction industry, like in most other developing nations is divided into two major groups: the organized; “formal”, and the unorganized, “informal” sectors of the industry according to their business structure and mode of operations. The formal sector is based on the

institutional and regulatory framework designed by the colonial masters, long before independence.

The construction industry in Nigeria operates within the institutional structures of government and other organizations. Government ministries interact directly with the industry by regulating its activities or act on behalf of government as financiers, suppliers or clients. NonGovernmental Organizations (NGOs) also influence the activities of then industry in areas of unionism, employers' organizations, private clients, donor agencies, professional bodies, research institutes and private educational institutions. The agency responsible for overseeing the activities of the industry and implementation of the state policies is the Federal Ministry of Works and Housing (FMW&H) and the State Ministries of Works in various states.

The organized sector of the construction industry, for which all the data available is derived from constitutes all the major companies, which are legally registered in the country and carry out organized construction projects with a combination of both highly skilled expatriates and labourers. This sector operates under set rules and regulations, including adherence to national laws on employment, procurement, and tendering. The government is aware of all the activities of this sector and collects frequent taxes from the companies.

The unorganized sector or informal sector, for which no accurate and reliable data is available on, comprises of the simple residential buildings and similar structures built by private citizens and constructed through the efforts of gangs of artisans and labourers, hired mainly using the multiple primes method of construction, that is, owner supervised construction. The government has almost insignificant influence on the operations of this sector and receives little or no revenue through taxes; hence, it is very difficult to obtain reliable statistical data about this sector.

However, the informal sector is polarized with few foreign construction companies undertaking large infrastructural projects, while the local or indigenous contractors constitute the remaining part of the sector. The local contractors consist of small builders and clients seeking to engage in the construction of single dwelling houses for families and so rely on labour intensive methods of construction. This is probably because labour is cheap and therefore makes economic sense than capital intensive option of construction. Besides, these groups of contractors who operate mainly as small scale enterprises in the industry find it difficult to access credit facilities required to execute large infrastructural projects (ADB 2008).

According to Dantata (2008), the performance of the construction industry in Nigeria is constrained by a significant number of challenges including the lack of local skilled labour, power shortage, the unavailability of materials and the unethical practices that are very common in the industry.

GEMS(2010) supported this view by stating that the growth of construction in Nigeria is constrained by multiple failures in areas such as obtaining land for development, high risk cost and delays in obtaining planning permission, registration of title to land, obtaining construction permits, skill shortages resulting from poor system of technical and vocational education and training, and high cost of construction materials arising from tariff and non-tariff barriers on the importation of building materials such as steel, timber and cement.

The situation is made worst by market failures which have put the indigenous contractors into a disadvantage position and concentrated market powers in the hands of a few large/mega developers (including multinational construction companies) and contractors who have the technical and financial muscle to execute large projects.

Over the years, there has been increased competition as new companies including foreign and local have entered the Nigerian construction market and a few indigenous construction firms have enlarged their capacities to service both the private and public sectors. Nevertheless, Julius Berger Nigerian Plc remains the leader in the Nigerian construction market in terms of activities (infrastructure sub-sector), assets and revenue.

We expect that in the short term, growth in the Nations construction activities will be stimulated by commitment of both Federal and state governments on infrastructural developments and increased participation in the Public Private Partnership Scheme (PPP Scheme) amongst others. However, the industry's growth will continue to be hampered by the harsh business environment and insecurity in the country which remain the major challenges for all industries in Nigeria.

2.2.8.1 Sustainable Development in the Construction Industry

The construction industry is particularly plagued more by risks than most of other industries (Flanagan and Norman, 1993), but often these risks are not dealt with adequately, resulting in poor performance with increased costs and time delays (Thompson and Perry, 1992). Nowadays, construction projects are becoming increasingly complex and dynamic in their nature and the introduction of new procurement methods means that many contractors would be forced to

rethink their approach to the way that risks are treated within their projects and organizations. The construction industry has often been accused of short-term goals with emphasis on higher margins and profits. Lack of investment in people, processes and technology is costing the industry from major contractors to specialist subcontractors (Liu, Flanagan and Li, 2003). Dealing with variations on health and safety issues on an individual project is all very well but what about the less tangible issues?

The risk of accepting the wrong client, tendering at lowest price and lack of succession planning or destroying a brand - these issues have a much greater long term effect on the risk profile of a business. Liu et al (2003) identified that lack of capacity in both the construction sector and in government, an uncertain economic environment, and lack of accurate data on which to base decisions are the main barriers to the realization of sustainable construction.

Akadiri, Chinyio and Olomolaiye (2012), noted that implementing sustainable building construction practice is a way forward in fostering economic advancement in the building industry while minimizing impact on the environment. They pointed out that, to reduce these detrimental impacts of construction on the environment and to achieve sustainability in the industry, three principles emerge: resource efficiency, cost efficiency and design for human adaptation.

2.2.9 The Construction Process

There are two categories of construction projects: building and civil engineering (Department of Trade and Industry, DTI, 2003). The first deals with the construction, improvement and maintenance of both residential and non-residential buildings whilst the second refers to the construction of an infrastructure such as dams, bridges and roads. In any case, traditionally the same steps have been used to develop the products of the industry. Hughes (1991) analyzed seven different sources in which the construction process was divided into two stages. There were similarities and differences among them but in general, the major decision points were identified as: recognition of customers' needs, schematic design, detailed design, construction documentation, contract, supply of material and components, assembly (construction) and commissioning. One of the sources analyzed by Austen and Neale (1984), who reported five sequential stages within the construction process based on international accepted practice. They were briefing, designing, tendering, construction and commissioning. Although these phases offer a simple portrayal of traditional procurement,

they will be used along with the decision points mentioned to explain how the process works and to understand its main features.

It is important to note, however, that the stages vary from project to project depending on the contractual arrangements for the particular project. Harris McCaffer (1995) summarized various contractual forms such as cost reimbursable contracts, two-stage tendering, serial contracts and management design. More recently, the American Institute of Architects (2004) defined three of the most common procurement approaches that are being used today within the industry: designbid-build, design-build and construction management at risk. While the first is normally recognized as the 'traditional' delivery method in which two separate contracts are typical, owner-designer and owner-builder, the second makes use of only one contract, ownerdesigner/builder. With regard to the last method, a construction manager takes the risk of building the project and an architect is hired under a separate contract. Having clarified this, Figure 2.11: Construction process and its participants based on the graphical representation proposed by Turin (2003)

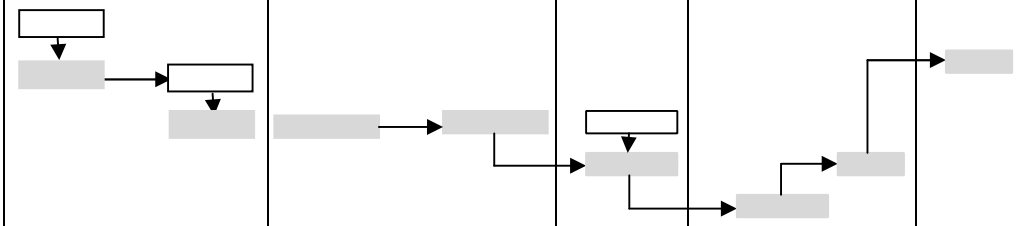
	Briefing	Designing	Tendering	Construction	Commissioning
	Customer Schematic Needs Design	Detailed Construction Design Documentation	Bidding	Materials & Assembly Components	Use
User Client Professionals Contractor Suppliers					

Figure 2.11: The Construction Process. Source: David 2006.

As can be seen, the horizontal scale represents the stages in the construction process while the vertical one portrays the main parties involved in each. Professionals include such personnel as the architect through to all types of engineers. Admittedly, there are other participants in the process such as local authorities, suppliers of services i.e. water, electricity, gas, sewage and telecommunication. However, they have not been considered in the representation for the sake of simplicity and because their exclusion does not affect the patterns of relationship between the main players (Turin, 2003).

The shadowed blocks within the figure, identify the participant responsible for the particular stage and the arrows represent the flow of information at each phase. The first stage in the process is called briefing, which includes the identification of customer needs and the elaboration of a blueprint. Here, the client (who could be the user) interprets the user requirements, approach an architect and sets the objectives of the project. At the designing phase, he passes the blueprint

onto various engineers, to carry out design activities. Once these are completed, a set of construction (production) documents is generated including working drawing, schedules, bill of quantities, time scales and specifications.

When all the production information is ready, the tendering stage takes place. Here, various contractors are invited to place bids and one is appointed to carry out the site construction work. The client has normally chosen the cheapest and most reasonable bidder (Egan, 1998). During the construction stage, various suppliers supply the components and materials required to assemble the structure, the main objective being to build the facility within the agreed time, cost and quality. Finally, the user takes over the finished building during the commissioning stage.

Different authors have discussed the various characteristics of the construction process(Koskela,2000, Evbuomwan&Anumba,1998, Turin,2003, Ballard,2000, and Ballard & Howell,2003) and its disadvantages which include: the fragmentation of the participants, the incidence of design changes and liability claims, the fragmentation of design and construction data, lack of life-cycle analysis of the project, lack of communication of design motivation and purpose, activities not planned early enough to avoid delays, too much focus on transactions and contracts, insufficient notice taken for stakeholders interests and lack of learning from previous projects.

The construction process has also been compared with an approach to product development in manufacturing known as the "over the wall" syndrome (Evbuomwan & Anumba, 1998), in which activities are carried out within functional departments that are responsible for each step in the process. Once the first department has finished its work, the results are sent to the second, which in turn continues the project and then transfers it to the third. The process continues successively until the product is marketed and distributed in the last stages.

This approach is the result of fragmentation of responsibilities between the participants involved in a project. In fact, as argued by Turin (2003), during the construction process, the reappearance of the same combinations of participants is mostly a matter of coincidence, and it is neither encouraged nor, in certain cases, permitted by codes of professional conduct of by restrictive practices rules. In addition, the participants in a construction project have different interests and constraints (Winston, 1997)

2.2.9.1 Participants in the Construction Process

In order to better understand the origins of fragmentation, the five participants listed in Figure 2.7, their main interests and constraints were briefly discussed. It is important to note that the owner of a project is the person or company that will own the finished facility. The owner could be the client or even the user in some cases. The users are the people who will use, work or live in the finished product. Their main interests include: the clear communication of their current and future needs to the client, professionals and contractor, and the receipt of the product on time, of good quality and that satisfies their wishes. Their main constraints are: the willingness of the client to listen to their needs, and the skills of designers and the contractor to translate their needs into a product that satisfies their requirements. Users want to avoid complaining at the end of the construction process because the final product does not satisfy their wishes.

The client can be considered as the motor of the process. When they are receiving financial support, one of their main motivations is to meet their responsibilities to their supporters on a timely basis and within budget with a quality product. In addition, they want to meet the needs of the users and to establish a good reputation as a developer in order to attract more business in the future. Their main constraints are the financial supporter's conditions and guidelines, the professionals' and contractor's contracts, and restrictions imposed by community representatives working on the project. The client wants to prevent the project from collapsing, delays caused by disagreements and long-term maintenance problems resulting from defective construction.

Professionals such as architects, builders, quantity surveyors, civil, mechanical and electrical engineers are responsible for the developmental work. Among their interest are: to design a quality facility on time and within budget and to exceed clients' expectations. They also have two main constraints: the contract with the client and relevant regulations and codes. These "players" want to avoid: the postponement of a project because of high bids or unqualified contractors, the construction of a poor quality product, and errors, and omissions in their designs. The contractor is responsible for building the facility in question. Their main motivations for taking part in a project are: to make a profit, to finish the job without delays, and under budget, and to produce a quality product which will encourage repeat business with the client. Among their main constraints are the contracts with both the client and the subcontractors. The contactors wants to prevent under bidding, doing re-work without being compensated and delays, which cause extra operating costs.

Suppliers are in charge of providing the materials and components to carry out the construction work. Among their interest are: to supply quality products on time and to repeat business with contractors. Their main constraint is the contract with the contractor. These "players" want to avoid supplying poor quality products that are the causes of problems later in the construction process.

Although not represented in Figure 2.7, other participants in the construction process are regulatory authorities' e.g. local building authorities and suppliers of service e.g. water. Their main interests are to comply with codes and regulations and to collect fees. They are constrained by legal regulations and want to avoid being ignored.

As can be seen, there are many different "players" taking part in a construction project, all of them with their own priorities. Evboumwam and Anumba (1998) argued that this fact could lead to fragmentation because the construction process included many activities from determining customer requirements to construction and life-cycle maintenance. For instance, while users may be interested in communicating their requirements to clients and professional, clients may be more interested in obtaining a quality product within budget, than in listening to the user's needs and professionals may be more interested in finishing the product on time in producing a quality product. Fragmentation then, is the result of many participants, with different interest, working on the same project.

In addition to the features of the construction process and participants, production in construction has some peculiarities, which do not contribute to improve the situation.

2.2.9.2 Characteristics of the Construction Process

The Construction Industry has certain characteristics that set it aside from other sectors like: manufacturing, health, mining, etc. Walker (2002) linked these to four types of uncertainty:

a. Natural: When construction products are made, they will remain in an uncontrolled environment subject to problems of weather, uncertain ground conditions and access;

b. Task: The construction projects are normally one-of-a-kind i.e. each project requires a new design with new production problems to be solved;

c. Organizational: Each project is undertaken by a temporary organization and variations in project size and type means that personnel requirements change;

d. Contractual: The contract depends on the features of the projects.

Koskela (2003), based on an analysis of the literature, categorized the characteristics of construction into three groups: one-of-a-kind, site production and temporary organization. Turin (2003) mentioned changes in the nature of the product, in the functions of the professional and in the contractual relationships between parties. Essentially, construction projects differ from each other in terms of customer needs and priority, building location and surrounding, access weather problems, ground conditions, available materials and design solutions. Unlike manufacturing where repeat products are assembled in the same place, construction products are built at a different site each time.

Construction generally makes use of local labour, which adds to uncertainty. The space in which to build the structure should be organized differently each time because rather than having a product flowing through various workstations, teams should move from say paving to a wall. Moreover, the participants in one project may differ completely from those in another. Table 2.2 summarizes some of the characteristics inherent in the construction process, based on the classification proposed by Walker (2002). It is important to note that the lists are not exhaustive; they only show those features that could lead to variability, the cause of delays. For instance, if the weather deteriorates, the work sometimes has to stop. The combination of these characteristics is thought to be the origin of most of the chronic problems in the industry (Koskela, 2003)

Table 2.2: Characteristics Inherent in Construction

Natural uncertainty	Task uncertainty	Organizational uncertainty	Contractual uncertainty

-Location -Weather problems -Ground conditions -Access -Surroundings -Interruptions because of natural disasters (floods, earthquakes, hurricanes	-Different customer -Different priorities -Different design -Different codes -Space utilization -Different production Infrastructure (machines) -Different materials	-Local labour -Local suppliers -Local subcontractors -Different design team -Different customer	-Different responsibility -Different authorities -Different subcontractors

Source: David 2006

2.2.10 Nature of Construction Projects

Projects in the construction industry are inherently subjected to more risk and uncertainty than those in most other industries. For example, the required duration of completion of an activity will normally depend on the availability of resources (labour and equipment), on weather conditions and on the availability of materials. Quite often, construction projects fail to achieve their time, quality and budget goals. The purpose of risk analysis and management is to help managers to avoid or minimize the economic impact of these failures.

Each construction project is by its nature different. Based on the uniqueness of the project, there are many special problems in construction. Construction is viewed as a high risk business and that the future cannot be forecast, but some writers like Raftery (1994), Flanagan and Norman (1993) does not agree with these rather negative viewpoints. Raftery (1994) in his opinion suggests that, there are many features common to a wide range of construction projects. Most projects will have a start date and a finish date. Most projects will be designed and built by teams of people and firms drawn together for that particular project. Most projects will require contractors to marshal labour, equipment, materials and components to a specific site. Many physical elements of construction will reoccur across projects. For example, all bridges need a deck and a supportive structure. All buildings need a substructure, cladding and services". Indeed, looking at risk in a systematic way Flanagan and Norman (1993) stated that the typical risks on a construction project include:

1. Failure to achieve completion within the stipulated design and construction time.

2. Failure to obtain the expected outline planning, detailed planning or building code / regulation approvals within the time allowed in the design program
3. Unforeseen adverse ground condition
4. Exceptionally inclement weather
5. Strike by the labour force
6. Unexpected price rises for labour and materials
7. Failure to let to a tenant upon completion
8. An accident to an operative on site causing physical injury
9. Latent defects occurring in the structure through poor workmanship
10. Natural disasters (flood, earthquake etc)
11. A claim from the contractor for loss and expense caused by the late production of design details by the design team.
12. Failure to complete the project within the clients budget allowance

In other to forecast these risks, traditional methods of forecasting risks are usually employed which rely upon intuition and feel (Flanagan and Norman, 2003). This is clearly inadequate in modern construction project management. Risk analysis and management provides a systematic framework in which management can pay greater attention to risk and thus improve on project performance.

2.2.11 Management of Construction Projects

According to Mousa (2005), the construction contractors on the whole have been slow in applying proper management methods to the conduct of their business. Management in the construction industry have been characterized as being weak, insufficient, nebulous, backward and slow to react to changing conditions. Nevertheless, in the overall picture, the construction industry is at or near the top in the annual rate of business failures and resulting liabilities (Clough and Sears, 1994). The following explanations are given, why the construction has been slow in applying management procedures that have proven effective in other industries. The reasons as identified by Raftery, (1997) are:

i. Construction projects are unique ii. Construction projects involve many skills largely non-repetitive in nature.

iii. Projects are constructed under local condition of weather, location, transportation and labour that are more or less beyond the contractor's control.

iv. Construction firms, in main, are small operations, with the management decisions being made by one or two persons (Clough and Sears, 1994).
v. There are special problems in construction.
vi. Vi. The future cannot be forecasted
vii. vii. Construction is a high-risk business.

2.3 Empirical Review

2.3.1 Global Overview of Building Collapse

All over the world building constitutes one of the most valuable assets to mankind. However, whereas these buildings provide humanity with a great variety of accommodation in form of residence, churches, mosques, offices, schools, hospitals, etc, they also provide employment for the skilled and unskilled (Oke, 2011).

Building collapse is a phenomenon witnessed all over the world irrespective of the state of development of the construction sector of any country. However, statistics suggest that developing countries such as Nigeria are more prone to such collapses compared to the more developed countries in the world (Bala 2017). This would immediately suggest that there could be avoidable building collapse risk factors prevalent in such countries which increase the likelihood of such occurrences

The phenomenon of building collapse is characterized by the compromise in the structural integrity of a building's structural elements, resulting in its eventual failure (Bala, 2017). Structural failure refers to the loss of load carrying capacity of a structural component or the structure itself (Roddis, 1993). In other words, the failure of the structural components to perform as designed (Wardhana and Hadipriono, 2003). The failure in many cases renders the building unsafe for habitation or continuation of construction activities and could eventually lead to collapse, damage to property and loss of lives. Wardhana Hadipriono

(2003) also distinguished between partial and total collapse depending on the extent of collapse. A total collapse would imply that primary structural members have collapsed eliminating the possibility of occupancy below and requiring a total replacement of the building. A partial collapse occurs where some primary structural members have collapsed posing danger to inhabitants and nearby structures. It is important to distinguish between cosmetic failures which could be cracks or distress which could be cracks or distress which is the un-serviceability of a structure or its components that might not lead to collapse

According the report by Corbett (2015), on the 24th April 2013, an eight storey commercial building, Rana Plaza collapsed in Savar, sub-district near Dhaka, the capital of Bangladesh Not less than 547 people died and about 2500 were injured with many still missing. This is

considered to be the deadliest garment factory accident in history. It has been reported that the elected Mayor of the Municipality has been suspended for alleged negligence in approving the design and layout of the building including the addition of three storey for the Plaza. However, he said that Bangladesh has about 4,000 garment factories and export clothes to leading Western retailers, and industry leaders hold great influence in the South Asian nation. Its garment industry was the third largest in the world in 2011, after China and Italy. The shortage of land and propensity for flooding in Bangladesh has prompted many factory owners to build up, rather than out. Additional floors are often hastily added without reference to building codes and approvals. Many factory owners who couldn't afford to build new buildings because of high cost of land and limited access to utilities converted hundreds of residential and other buildings into makeshift garment factories to keep up with the demand from Western retailers.

He also reported that on 17th July, 1981, two suspended walkways through the lobby of the Hyatt Pegency Hotel in Kansas City, Missouri, USA collapsed killing 114 and injuring 200 people. It stated that the collapse was due to late change in design, altering the method in which the rods supporting the walkways were connected to them and inadvertently doubling the forces on the connection. The failure highlighted the need for good communication between design engineers and contractors, with checks on design changes. The failure is a standard case study on engineering courses around the world, and is used to teach the importance of ethics in engineering.

In the Daily Graphic Newspapers (2015), Mark Bediako reported that between 2012 and 2014, Accra the capital city of Ghana, officially recorded four major building collapses that claimed a total of 19 lives. The Melcom building collapse near Achimota in 2012 claimed 12 lives, whereas the Grad View Hotel building collapse at Nii-Boi Town in 2014 and recorded four deaths. Two other buildings collapsed in 2014; the building near Akai House at Cantonments claimed one life while the Central University Hostel building collapse in Dawhenya recorded no deaths. Also another multi-storey building collapsed in the Cantonments that recorded three deaths. A critical review of these buildings showed that almost all the buildings that collapsed within the period were privately owned buildings.

In addition, the case of Naval Building, Abuja Nigeria was examined by Fakere et al (2012) as stated by Ebihikhalu and Dawan (2014). The collapse of the Naval building, a two storey building in Gwarimpa, Abuja occurred on Saturday, 28th January, 2012 (See Plate 5, Appendix B). It was reported that 15 people were busy on the site when the building collapsed; 2 died, 1 seriously injured and the others escaped with minor injuries. The building under investigation had been described by the Federal Capital Development Authority (FCDA) as precarious and had been marked for demolition before it eventually collapsed. However, this elicits the fact that the structure was defective, hence the need to investigate the factors responsible for this.

2.3.2 Building Collapse in Developing Countries

The case of building failures and consequent collapse of structures in developing countries like Nigeria, Cameroon, Ghana, etc had reached an alarming stage in the past five years. Reporting collapsed buildings in these countries was comparable to flood disaster, earthquake, tsunami, Florida Hurricane, volcanoes and aeroplane crash, considering the enormity of loss of lives and destruction of properties.

Buildings are constructed to serve as shelter for man and his activities in an environment (Amadi, Eze, Igwe, Okunlola & Okoye 2012, Oseghale, Ikpo & Ajayi 2015), therefore, they must be properly designed, well planned, constructed and maintained to obtain desired satisfaction from environment. However, recent events in some developing countries like Nigeria have seen these buildings as a growing cause of death, loss of properties and left many people injured. Tehamba and Bikoko (2015) carried out a study on the failures and collapse of building structures in the cities of Yaounde and Douala. Cameroon from 2010 to 2014 and attributed the causes to absence of soil investigation and foundation, structural

design, detailing, degradation due to environmental factors, use of poor quality materials, excessive overloading and concrete processing.

Kioko (2014) in his own study identified the causes of building failures in Africa as use of substandard building materials, poor workmanship by contractors, faulty construction methodology, heavy down pour, non-compliance with specification or standard by developers and contractors, lack of supervision, poor inspection and monitoring, defective design, illegal conversion and alterations. He opined that in order to reduce the incidences of building collapse in any country (Africa), The National Society of Engineers and other government agencies should work on availing a code of practice that will match with the local materials used in a

particular region and ensure that clients employ a qualified engineer, builder or project manager to supervise the project. The researcher agrees with the opinion of Kioko (2014), therefore, it becomes imperative that the National Building Code should receive the blessings of the National Assembly to curb the menace of building collapse in Nigeria.

A study by Owusu (2017) on the collapse of buildings in Ghana (the role of stakeholders) identified the followings as the causes of building collapse: poor attitude of clients, poor work by contractors, lack of monitoring and supervision by regulatory bodies, poor design, structural failures and disregard to building regulations by contractors. The study also points out inadequacy of legal framework and recommends review of regulatory bodies, monitoring, supervision and enforcement of laws as appropriate mechanisms for preventing collapse of buildings in Ghana.

The researchers in the building industry have identified the major causes of building failures across Africa. In 2007, a study by Emmanuel in Nigeria revealed causes related to structural failures, faulty design, fault on construction sites and product failure (Usman, Chen & Lodson, 2010).Usman et al (2010) also identified also identified six environmental factors responsible for building collapse. These were poor quality of blocks used, poor quality of concrete, bad design, poor compaction and consolidation, faulty construction and extra ordinary load.

Chendo & Obi (2015) identified few instances of natural occurrences such as flood, earthquake, heavy wind causing collapse of building in major cities of Nigeria; they noted

that building collapse was mainly due to human errors such as faulty design, faulty construction and use of substandard building materials, negligence, omission, ignorance, quackery, corruption and sabotage.

Ode (2010) in his own study grouped the causes of building failures in Nigeria as; non-adherence to the building codes and lack of adequate information on applicable code, use of use of unskilled labour, poor supervision, poor materials, flooding, ignorance, lack of maintenance, overloading, conflicts among professionals and tendency of some professionals to step into some lucrative technical fields without the appropriate skill, corruption and tendency to cheat.

In a related studies titled "Tackling Causes of Frequent Building Collapse in Nigeria", Oloyede, Omoogun and Akinjare (2010) looked at the causes of building collapse from three angles; building experts, public opinion and academia. This study revealed divergent views. Building experts blamed building collapses on the use of low quality building materials coupled with employment of incompetent artisans and weak supervision of workmen on site. Public opinion bemoaned non-compliance with specifications/standards, use of substandard building materials and equipment and the employment of incompetent contractors while those in the academia blamed on the non-enforcement of existing laws and endemic poor work ethics of Nigeria at large.

The contribution of the informal sector to building collapse has also been examined by Fagbenle & Oluwunmi (2010). They focused on six major states from each of the six geo-political regions of Nigeria. The study found that 70% of the reported cases of building collapse in Nigeria stemmed from the informal sector. Both the private and the informal sector were associated with hasty construction, low quality workmanship, poor supervision, inexperience (use of incompetent hands), ignorance, evasion/non-compliance with building regulations and nonenforcement of building quality, standard and control on construction site market.

Ojo, Olabintan & Salami (2013) carried out a study on building collapse in Nigeria. The study focused on design supervision processes as means of structural fortification for prevention of building collapse. Among other things, they identified the factors responsible for the failure of building design and construction supervision process and recommends solutions to them since their continuity may result to serious structural instability. It examines records of some reported building failures/collapses in Nigeria, structural defects in some

selected roofs and the extent of professional involvement in their design and construction. The paper concludes that structural sustainability can be greatly improved upon through design and construction supervision by depending on highly skilled professionals with intention to minimize any potential ambiguity, disputes, fraud and building collapses/failures. The study finally recommends the integration of quality assurance committee to monitor structural quality and ensure adherent to building codes and regulations.

A study by Kioko (2014) investigated the collapse of a 4-storey building under construction in the central business district in Nairobi, another building in Kisumu City (January, 2013) and a 4storey building under construction in Mlolongo (June 9, 2012) all in Kenya. The study identified a number of reasons why the buildings had collapsed and these include; the concrete mix ratio not being right, lack of enough planking and strutting in place to uphold excavations, the column spacing being too wide, poor reinforcement, the slenderness ratio being too high, cost cutting by contractors such as changing recommended concrete mix or reducing the amount or recommended reinforcement and a multitude of other reasons.

The study observed that building failures occur due to use of substandard building materials, poor workmanship by contractors, use of incompetent contractors , faulty construction methodology, heavy down pour, non-compliance with specifications or standards by developers and contractors, lack of supervision, poor inspection and monitoring, structural defects, defective design, illegal conversion and alterations.

2.3.3 Building Collapse in Nigeria (2009 – 2020)

In recent times, building collapse in Nigeria has been a source of concern to so many people particularly those associated with the construction industry. This is so because there are so many cases of building collapse all over the world and particularly in Nigeria (See Plates 1 to 9, Appendix B). Most of these cases had resulted into colossal economic losses in terms of lives and property. The cases of building collapse are some of the cardinal issues, which have created serious concern to all the professionals in the building industry such as the Architects, Engineers, Builders, Quantity Surveyors, Estate Surveyors and Valuers, Town Planners and Land Surveyors. The government is also worried about the frequency of collapse of buildings in Nigeria. However, Aderibigbe (2001) in his study admitted that the reoccurring event of building collapse has forced some state governments to enforce and

enact some laws recommending forfeiture of such buildings and prosecution of their owners. Some reported cases of building collapse in Nigeria from 2009 to 2020 are shown in Table 2.3 (Appendix H).

2.3.4 Causes of Building Collapse in Nigeria

Building collapse all over the world had been attributed to two phenomena; natural and manmade. The natural phenomenon is usually triggered off by natural occurrences such as earthquakes, flood, typhoon, volcanic eruption, landslide, tsunami, etc and when they occur is regarded as natural disaster. The man-made aspect is borne out of man's negligence in areas such as soil test, building design and planning for extra loads and stress from strong wind, and

earthquakes for tall building, foundation works, quality of building materials, lack of adequate monitoring of craftsmen and poor quality of workmanship (Ayedun et al, 2012).

Oloyode et al (2010) attributed causes of building collapse as due to man's negligence in some vital areas in construction such as soil investigation, incorporating for extra loads, stress from winds, earthquakes, uneven terrain, use of substandard building materials, poor monitoring and overall poor workmanship

Madu (2005) identified causes of building failures as due to natural occurrences such as earthquakes, tornadoes, flood, etc. other causes according to him include factors such as omission, carelessness, leading to use of deficient structural drawings, absence of proper supervision of projects, alteration of approved drawings, use of substandard materials, corruption in the Nigerian system, building without approved drawings and translocation of building plans to different sites.

Akande et al (2016), in their study categorized the causes of building collapse into two: (i).That caused by the influence of man. (ii) That due to natural forces (force majeure). The causes of building collapse due to the influence of man could be as a result of negligence or incompetence. In a communiqué issued at the end of a two day seminar on structural failure and building collapse in August 1996, professionals in the building industry summarized the major causes of building collapse to include the following:

1. The attitude of the public, professional bodies and government
2. The absence of soil test before construction, structural designs and details are sometimes defective.
3. Lack of proper planning
4. Absence of co-ordination between professional bodies and Town planning authorities
5. Lack of adherence to specifications by contractors
6. Use of unqualified and unskilled personnel
7. Poor or bad construction practices
8. Use of sub-standard building materials

9. Inadequate enforcement of existing laws

Dimuna (2010) in his own study summarized the causes of building collapse as follows:

a. **Use of deficient structural drawing: Buildings** have the tendencies to collapse when the drawing are based on false assumptions of soil strength. Also collapse could occur as a result of faulty structural details. Oyewale (1992) in his study identified desgn faults to be accounting for 50% of collapse of engineering facilities in Nigeria.
b. **Lack of Proper Supervision**: In some cases, where a structural is not deficient, the absence of proper supervision on the site by qualified personnel can still lead to building failure.
c. **Alteration of Approved Drawings**: Often times, the contractors during construction either on the directive of the client or in a bid to cut corners and maximize profit, alter approved building drawings without corresponding amendment to structural drawings to the detriment of the structure. This will definitely result to structural failure.
d. **Building Without Approved Building Drawings**: Where buildings are constructed without approved drawings or even no drawings at all, such can result to structural failure. In addition, when the drawings are not properly vetted by qualified professionals or relevant authorities before the buildings are erected. Without working drawings, all construction is usually based on assumption as earlier stated, and several errors can result thereby leading to structural failure.

e. **Approval of Technically Deficient Drawings**: The Town planning authorities at times approve drawings that are technically deficient. This may be as a result of ignorance or negligence on the part of Town planning personnel that carry out the vetting of such drawings, or as a result of outright corruption. Sometimes money may change hands resulting to the approval of such drawings.

f. **Illegal Alteration of Existing Buildings**: The clients in some cases, on their own carry out alteration of existing structures beyond and above the original design without any working drawings, and relevant Town Planning approval for such development. In some cases, existing bungalows are converted to either a storey or two or three storey buildings without any drawings and supervision by qualified personnel. The resultant effect will be structural failure.

g. **Absence of Town Planning Inspection or Monitoring of Sites**: The Town planning Authority staff doesn't often visit sites to inspect or monitor the progress of approved drawings on sites. Their interests are more on payments of approved fees and processing fees, and when the fees are received, the development will go on without the Authority knowing anything on the details of construction. Unfortunately, these details are only known when such buildings collapse and their elements get exposed for all to see. Probably, by that time lives may have been lost.

h. **Clients Penchant to Cut Corners**: Available literatures show that most of the collapsed buildings are residential and owned by individuals. That means, one person takes all the decisions concerning the construction and no due process is observed. The Nigerian clients, mostly individuals have the penchant for cutting corners by not engaging qualified personnel to produce the contract documents and supervise the building while under construction, as they want to spend minimal amount of money on the construction (Madu, 2005). Even where qualified professionals are employed for design and supervision, most clients insist on having the final say on what goes on the site to the detriment of proper execution of the construction work. Unfortunately, if there is any mishap on the site, the client puts the blames on the consultants and the contractor.

i. **Use of Sub-standard Materials**: The use of substandard materials especially reinforcement rods, steel sections and cement contribute immensely to building failures. Hall (1984) posited that the use of low quality materials is one of the major cause of

building failures. Also, Aniekwu and Orie (2006) in their study identified low quality materials as the most important cause of failure of engineering facilities in Nigeria.

j. **Inefficient Workmanship (Labour):** The inefficient and fraudulent inputs on the part of contractors and operatives in the building industry can also contribute to the building failures. In a situation where a contractor cannot read or interpret drawings, or he refuses to listen to the instructions of the consultants, the unexpected could happen. Oyewande (1992) in his study posited that faults on construction sites accounts for 40% of building collapse.

k. **The Activities of Quacks**: The invasion of the building industry by quacks also contributes to the incessant building failures in the country. A cursory look at the Nigerian Building industry reveals preponderance of individuals who are ill-equipped to carry out function associated with building construction. The unsuspecting public is also at a loss

differentiating the real professionals from the quacks until the real harm has been done. Nowadays, it is not unusual to find the staff of Town Planning Authorities who are mainly Town Planners and site inspectors, even some Builders and Land Surveyors masquerading as architects by deceiving the unsuspecting public. Also masons have overnight transformed to engineers and builders. This is a major problem of the building industry and ugly trend has to be seriously checked.

l. **Clients' Over Reliance on Contractors for Decision Making on Site**: Building failures also occur as result of clients' reliance on contractors than consultants in decision making on site. This could be because the contractors are either their friends, relations of the client, or are recommended by friends or relations. The result of this of this relationship is that client rely more on the contractors for decision making than on the consultants. The clients fail to realize that profit is the prime motive of most contractors and not that the contractor is saving them some cost. They may sometimes reduce the thickness of floor slabs, foundation depth, sizes of reinforcement rods, head room of structures, all in attempt to maximize profit to the detriment of the construction work, and because most clients cannot read drawings, they are taken for granted by most contractors. It is only when building collapse that these facts come to the surface. For projects owned by corporate bodies and governments etc, the contractors seem to have special relationship with agents of these clients , some desperate contractors use blackmail and intimidation to scare away and discourage consultants from visiting the project sites.

m. **Use of Acidic and Salty Water.** The use of acidic and salty water from sources like oceans and seas in the cities like Lagos and Port Harcourt can affect the strength of concrete when used in the mixture of cement, sand and rods. This will in turn result to structural failure.

Looking at the above enumerated factors, it shows that they are interlaced, the issue of soil being very central to the cause of building collapse especially during the rainy season when the water is on the rise. This is particularly in areas like Lagos and Port Harcourt. Therefore, more attention should be given to geotechnical investigation for high rise structures in areas suspected to have poor bearing capacity of soil and the water table is high. A typical example where the high rise is the norm is Onitsha in Anambra state, but so far no reported case of building collapses. The reason, being that the soil bearing capacity is very high in most areas of the city.

Divid (2009), in his study on building collapse identified the following as the causes of building collapse in the Nigerian construction industry:

a. **Bad Design**: This does not only mean errors in computation, but failure to take into account the loads the structure will carry, erroneous theories, reliance on inaccurate data, ignorance of the effect of repeated impulsive stresses and improper choice of materials or understanding of their properties. The responsibilities of all these failures rest on the engineer and are created at the drawing board.

b. **Extra-ordinary Loads**: These are often natural, such as repeated heavy snowfalls or the shaking of an earthquake or the winds of a hurricane. A building that is intended to stand for some years should be able to meet these challenges. A flimsy flexible structure may void destruction in an earthquake while a solid masonry building would be destroyed. Earthquake may cause foundation problems when moist filled land liquefies which can cause building failure.

c. **Faulty Construction**: Faulty construction has been the most important cause of structural failures, the builders and engineers are also at fault. This is prominent if the supervision is lax (i.e. not strict, severe or careful enough about work rules or standard of behaviour). This includes the use of salty sand to make concrete, the substitution of inferior steel for specified one, bad riveting or even improper tighten torque of nuts, excessive use of the drill pin to make holes line up, bad welds and other practices well known to the construction workers.

d. **Faulty or Failing Foundation**: Even an excellent designed and constructed structure will not stand on a bad foundation. Though the structure will carry its loads, but the earth may not. The living Tower of Pisa is a famous example of bad foundations, there are many others. The Saint Paul Minnesota sunk to a feet or more into soft clay but did not collapse The displacements due to bad foundation may alter stress distribution significantly. This was such a problem with railway bridges in America that statically determine trusses were greatly preferred since they are not subject to this danger.

e. The incompetence of contractors or craftsmen is a serious issue that can lead to building collapse even before the completion of such project. Where those in charge of the project are not capable or able to do the correct thing at the right time on site, it may lead to building failure, e.g. improper columns, poor erections, poor setting, poor mixing, etc and as well lack of professionalism.

f. **Unapproved Plan or Self-Help Method**: Many property owners and developers deviate from plan approved in order to reduce cost of construction. In doing that, they may not take proper design structurally or in a wrong location, and so will not meet the standard of building code and build for their personal satisfaction, which may eventually lead to collapse.

g. **Corruption and Greed:** Many of the contractors, professionals in the building industry, and even the government are corrupt and selfish, the contractor will minimize cost to the barest minimum by buying substandard materials, so as to keep some money in their personal pocket, even when they have collected their contract fee for the job. Some architects, builders and engineers will emerge in for more contract by this, will not be able to supervise the job properly. Also the unscrupulous government officials that are sent to site to inspect the materials that are used are also collecting bribe for their selfish interest and will not see anything wrong on site of interest even when all is not right.

h. **High Cost of Building Materials**: This is a major challenge to poor developers who want to have shelter at all cost but may not be able to buy the quality materials due to high cost and persistent increase on a day to day basis. By this they will go for less quality materials which is harmful and may eventually lead to building failure.

i. **Spiritual Attack:** In the Nigerian context, some research also show that charm and spiritual attack can lead to building collapse, even if the building is free from any structural defect. If there is an existing problem on land issue or people fighting over a piece of land, some may go extra mile by using charm or placing charm on the site of the development or while developing the building before completion it will collapse and no structural fault will be traced to it.

j. **Lack of Maintenance**: In Nigeria, maintenance culture is lacking. Many property owners are more interested in building new structures instead of maintaining the existing ones. When building are not maintained, it will reduce the lifespan of such building, such as buildings with crack walls, broken louvers, sagging roofs, roof leakages etc. All these reduce the strength of the building, as one thing leads to another.

k. **Natural Disasters**: These are unforeseen circumstances that naturally occur (force majeure). Some of the natural disaster include; earthquake, landslide, erosion, thunderstorm, lightening, tsunami, volcanic eruption etc. These natural disasters cannot be stopped or prevented since they occur unawares and natural.

l. **Unexpected failure Modes**: These are the most complex of the reasons for building collapse. Structurally, any new type of structure is subjected to failure until its properties are well understood. Suspension bridges seemed the answer to bridging large gaps. Here everything is supported by a strong cable in tension, a reliable and understood member.

Bertram (2018), in the survey conducted on building collapse in Nigeria revealed that the South-West Region of Nigeria has the highest record of building collapses in the last eight years, with Lagos State accounting for about 134 deaths and 159 injuries. In addition to the stated figures of fatalities in the reviewing period, is the collapse of the six-storey Synagogue Church of All Nations (SCOAN) guesthouse that led to 115 deaths with 131 injured in 2014 (Bertram, 2018).

Also, on March 13, 2019, 20 people including school children, the school administrator (female0 and other occupants of the building were reported dead in a three-storey building collapse at Massey Street, Ita-Faaji area of Lagos Island, Lagos State. The collapsed building served as a residence, private school for children (nursery and primary), shops, offices and business centres. It was reported that forty-five people including women and children were rescued alive,

sustaining various degrees of injuries (https://www.independent.ie/world-news/20-confirmeddead-after-children-caught-innigeria-building-collapse-37916929.html)

Similarly in Ibadan, on March 15, 2019, a two-storey building under construction at Sogoye in Idi Arere area of Oyo State collapsed resulting in the injury of five construction workers (https://www.thecable.ng/oyo-no-death-recorded-in-ibadan-building-collapse). It should be noted that the frequency in building collapse in Nigeria poses a serious concern to public safety and urban development, as the recurrence and magnitude of losses in terms of lives, properties and investments are becoming alarming (Dabara, 2016).

Odeyemi, Giwa and Abdulwahab (2019) in their study on building collapse in Nigeria (2009 – 2019) revealed that South-West geopolitical zone experienced the highest number of collapses and the highest loss of lives during the period reviewed, followed by the North Central, South East , South South, North East and lastly North West geopolitical zone.

Adebowale, Gambo, Ankeli and Daniel (2016) in their study carried out analysis and evaluation of the dearth rate involved in 47 reported cases of building collapses in Nigeria between 2000 and 2010. The result of the analysis showed that over 300 death rates were recorded for Lagos, Abuja and Port Harcourt which are the three major areas with high rate of casualties.

2.3.5 Building Collapse Risks

Risk is inherent in construction projects in all the activities, stages and phases. Risk is an uncertain event or condition whose outcomes can be detrimental to the attainment of the project objectives. Risk can be described as an exposure to possibility of economic and financial loss or gain, physical damage or injury or delay as a consequence of uncertainty associated with pursuing a particular course of action.

Building collapse is a phenomenon characterized by the compromise in the structural integrity of a building's component elements, resulting in its eventual failure. Structural failure refers to the loss of load carrying capacity of a structural component or structure itself, that is, failure of the structural component to perform as designed (Bala 2017). This structural failure in many cases renders the building unsafe for habitation or continuation of

construction activities and could eventually lead to collapse, damage to property and loss of lives, which defines aspects of risk the major problem or subject that form the basis of this research.

Building collapse risk can be described as an event or condition that could cause negative consequences on the building users, stakeholders, investors and general public, and hence affect the project objectives (Akande, Debo-Saiye, Akinyobi, Alao and Akinrogunde 2016).

Building collapse risks can be observed as "Threats to Success". The building collapse risks are usually in the form of economic and social implications, and they include; loss of human lives, injuries, investments, jobs, incomes, loss of trust, dignity and exasperation of crises among the stakeholders and environmental disaster (Ede 2010).

Obodoh, et al (2019) in their study on the effects of building collapse risks on the professionals in the Nigerian construction industry observed that the building collapse risks factors that have predominant effects on the professionals include ; loss of reputation, waste of resources, time and labour, loss of trust, etc. They recommended that all collapsed buildings should be properly investigated by a well constituted panel set up by the government and all the stakeholders found to have contributed to the collapse be persecuted to serve as deterrent to others

2.3.6 Management of Building Collapse Risks

Building collapse is defined as a state of complete failure when the structure has literally given way and most members have caved-in, crumbled or buckled (Obiechina, 2005). The collapse of building structures has a negative effect on the human race, leading to loss of human lives and properties, apart from the huge financial burden they have posed on government spending. Asides the loss of lives and destruction of properties, the management of building collapse risks has a negative effect on government spending. These include: human, material, economic, social and political costs.

There are few available literatures on the management of building collapse risks. The available literature concentrates on the management of natural and man-made disasters. Amongst the man- made disasters is the building collapse in which the risks associated

therein form the discourse. Throughout history, public policy makers have sought to anticipate the unexpected in order to reduce the risk to human life and safety posed by frequently occurring building collapse especially in developing countries like Nigeria.

Indeed, the government should take the lead in the management of disasters by establishing institutions and agencies that would be saddled with responsibilities of mitigating, preparing for, responding to and recovery from disaster occurrences. Guido Bertolaso, Head of the Italian Civil Protection Agency (2010), lends his voice to this by expressing that

Government should take the lead in implementing preventive actions both directly, by allocating efficiently public resources, and indirectly, by showing people how to protect themselves against disaster occurrences.

These, no doubt have occasioned an increased global cooperation in reducing the effects of disasters. Also, it has made governments at national levels to established agencies to take care of emergency-related issues/events. In the United State of America for instance, in respect to its federal status, there is the Federal Emergency Authority, National Response Framework, and National Incidence Management System (NIMS) are in place at different levels of government. In Australia, the body responsible for emergency management is Emergency Management Australia. Also, countries like Germany, India, Pakistan, Netherlands, United Kingdom, Canada, to mention but a few have corresponding emergency relief/management bodies.

Nigeria, a country that presents a veritable landscape for the study of hazards, calamities and catastrophes, especially the human-induced ones, is not exempted in disaster management. It is recorded that successive governments in Nigeria have made feeble efforts especially in the 1970s. However, in 1999, with the establishment of National Emergency management Agency (NEMA) under Act 24, the stage was set for the country to move away response/relief-giving centric that characterized emergency management before this period, to a more proactive mitigation/preparedness-centric approach. However, to achieve the huge task set before it, The Federal Government of Nigeria, through NEMA, came up with different strategies and programmes, and one of such was the National Disaster Management Framework (NDMF), which is a comprehensive Disaster Management document. The NDMF was to serve as a foundation upon which all plans, policies, programmes and procedures for Disaster Management can be created, developed and sustained (NEMA, 2001)

Several researchers agreed that building collapse cause a lot of havoc in the built environment. Hence, the need to find a solution to mitigate this ugly incident calls for serious attention. According to Stella (2010), the need for a functional Building Code that enforced against all odds has always been canvassed for at the end of the occurrence. After a short while, the clamour dies down until another collapse occurs. Then the canvassers will return to the drawing board.

The National Assembly should be prevailed upon to pass the National Building Code into law as its provisions are comprehensive enough to address the problems of the construction industry.

The risks associated with building collapse and the impact in the Nigerian economy and the stakeholders in the built environment calls for urgent attention to reduce or if possible eliminate the ugly incident. All hands should be on deck to curb the havoc caused by the building collapse as the effect is usually felt by all and sundry.

Some of the mitigation measures that could be adopted to curb this menace are summarized below. There should be adequate funding and monitoring of the activities of all emergency services such as National Emergency Management Agency (NEMA), State Emergency Management Agency (SEMA), Local Emergency Management Agency (LEMA), Red Cross Society, Fire Services, and NGOs among others.
Other mitigation measures that could help in reducing or eliminating the effects of building collapse risks include:

1. Evacuation and emergency services
2. Provision of temporary housing and feeding
3. Reconstruction of damaged areas
4. Property insurance
5. Life insurance
6. Reduce or avoid losses from building collapse
7. Prompt assistance to the victims
8. Rapid and effective recovery

9. Maintenance of law and order

10. Prevention of trespassing, looting etc

11. Recovery of dead bodies and their disposal

12. Medical care for the injured

13. Supply of food and drinking water

2.3.7 Factors Affecting the Existing System of Managing Building Collapse Risks in Nigeria

The management of building collapse risks and other natural/human induced disasters in Nigeria is the responsibility of NEMA assisted by other sister agencies such as Red Cross Society, Fire Service, Nigeria Civil Defence, NGOs, etc. Disaster management is the coordination and integration of all activities necessary to build, sustain and improve the capability to prepare for, protect against, respond to and recover from threatening or actual natural or human induced disasters (NDMF, 2010). The National Disaster Management Framework (NDMF) provides a mechanism which serves as a guide line for effective and efficient disaster management in Nigeria.

Adefisoye (2015) in his study on Assessment of Nigeria's Institutional Capacity in Disaster Management identified the following as the challenges/problems confronting disaster management in Nigeria:

i. Lack of proper coordination of disaster/flood management activities in Nigeria

ii. Insincerity on the part of the government to provide functional emergency services especially at state and local government levels.

iii. Absence of functional emergency services in most of the 36 states and the 774 local councils iv. Poor funding of the emergency management agency

v. The poor attitudinal disposition of Nigerians towards emergency situations (nonchalance, despondency, cynicism, mistrust and despair) by Nigerians towards the government establishments and particularly emergency situations.

vi. Hostilities to rescue workers at emergency scenes due to poor performance and inefficiency in service delivery

vii. Inadequate manpower, skills and materials

viii. Absence of disaster management training platforms for Nigerians to acquire the necessary knowledge that would aid emergency responses

ix. Disaster management is seen as solely the function of government and its agencies which are assigned to undertake the task

x. Government-centered approach to disaster management instead of decentralized community participation as practiced in many countries.

Adio-Moses and Taiwo (2019) in their study found the following as the weaknesses of the disaster management in Nigeria:

1. Low capacities in terms of human and material resources.
2. Inadequate funding and equipment
3. Inadequate education and awareness at the community level
4. Poor attitudinal disposition of Nigerians towards emergency situations
5. Hostilities to rescue workers especially in face of poor performance and inefficiency in service delivery
6. Inadequate manpower, skills and materials
7. Disaster occurrences perceived as 'the wrath of gods'
8. Lack of disaster management training platforms for Nigerians to acquire the necessary knowledge that would aid emergency responses.
9. Disaster seen as the function of government and its agencies assigned to undertake such task.
10. Lack of proper coordination of disaster management activities in Nigeria
11. Insincerity on the part of government to provide functional emergency services especially at State and local government levels
12. Lack of a good early warning system to ensure accurate and timely emergency response when disaster occurs.
13. Lack of effective land use planning
14. Inadequate regulation and enforcement of land use regulation

Essoh and Abutu (2018) carried out a study on "Managing National Emergency in Nigeria: Prospects and Challenges" and identified the following as the weaknesses of disaster management system in Nigeria:

i. Lack of inter-organizational coordination and collaboration among the emergency management agencies.
ii. Misrepresentation of casualty figures
iii. Patient tracking
iv. Dearth of ambulance services and rescue equipment
iv. Lack of adequate recovery effort
v. vi. Poor enforcement of environmental policies particularly in rural areas.

Oruonye, Ahmed and Tukura (2016) in their study on "Strengthening Capacity Building for Disaster Management in Taraba State: A Panacea for Sustainable Development" identified the following challenges/problems to disaster management in Taraba State, Nigeria:

1. Lack of skilled personnel in the various aspects of disaster management especially in project management/first aid services.
2. Inadequate coordination among the various stakeholders in disaster management
3. Poor funding of the agency by government
4. Lack of vehicles and ambulances to facilitate movement of disaster management personnel and volunteers.
5. Inadequate equipment for critical stakeholders for effective preparedness and response
6. Inadequate dissemination and sharing of information among stakeholders and donor agencies.
7. Politicization of the disaster management system
8. Inadequate education and awareness at the community level

9. Poor early warning system that will ensure accurate timely emergency response

10. Low institutional capability in data generation, risk analysis and early warning services in disaster management in the state and country.

11. Low level of disaster risk participation at the local government areas and communities.

However, it can be argued that the existing system is not enough or adequate to curtail the menace of building collapse risks in the study area. In agreement with Adefisoye (2015), formulating new policies and framework is necessary to achieve effectiveness in managing building collapse risks. The existing system of managing building collapse risks has been exposed to several factors which make the system ineffective. Table 2.3 shows the factors affecting the existing system of managing building collapse risks

Table 2.4: Factors Affecting the Existing System of Managing Building Collapse Risks in Nigeria

S/No	Factors Affecting the Existing System
1	Lack of inter-organizational coordination and collaboration among the emergency agencies
2	Insincerity on the part of government to provide emergency services
3	Lack of adequate funding
4	Poor attitudinal disposition of Nigerians towards emergency situations
5	Perceive of disaster occurrences as “the wrath of the gods”
6	Absence of training platforms
7	Poor urban planning

8	Inadequate education and awareness at the community level
9	Hostilities to rescue workers especially in face of poor performance and inefficiency in service delivery
10	Inadequate manpower, skills and material resources
11	Politicization of the disaster management in Nigeria
12	Poor enforcement of environmental policies particularly in rural areas
13	Absence of functional emergency services in most of the 36 states and 774 local councils
14	Inadequate dissemination and sharing of information among stakeholders and donor agencies
15	Disaster management seen as functional of government and its agencies assigned to undertake such task.

Source: Adefisoye (2015), Adio-Moses and Taiwo (2019), Essoh and Abutu (2018), Oruonye, Ahmed and Tukura (2016)

Some of the numerous problems confronting the management agencies in discharging their duties of managing disasters such as building collapse are further explained below. This has resulted that some of the victims do not get the required assistance from the Emergency Management Agencies such as NEMA, SEMA, LEMA, Nigeria Fire Service, etc. As a result numerous lives and properties are lost in event of building collapse. Some of the problems confronting the Disaster Management Agencies in managing the risks associated with building collapse include:

1. **Lack of Coordination and Control of Disaster Management Activities in Nigeria**

Disaster management is the coordination and integration of all activities necessary to build, sustain, and improve the capability to prepare for, protect against, respond to, and recover from threatening or actual natural or human induced disasters (NDMF, 2010). It is a multi-jurisdictional, multi-sectoral, multi-disciplinary, and multi-service initiative. As result, it is vital for agency like NEMA, SEMA and LEMAs, at federal state and local government levels, whose primary objectives are to coordinate other relevant stakeholders to wake up to their responsibility.

The Decree No. 12 of 1999, which established NEMA, charged the agency with broad mandate to coordinate and control the management of disasters in the country. NEMA is meant to coordinate the activities of other bodies like Federal and State Fire Service, Nigeria Civil Defense, State and Local Government emergency management bodies (SEMA and LEMA), the Engineering Unit of the Nigerian Armed Forces, Civil Society, and other stakeholders. However, the poor response to various emergency cases in Nigeria, especially the Synagogue building collapse in Lagos (2014), Lekki building collapse (2016), 2011 and 2012 flood incidents point to evidences of poor coordination. NEMA is not exercising the powers given it by the Decree No.12 of 1999 to coordinate and control the activities of other agencies or stakeholders in emergency management in this country. Every agency appears to be waiting and taking instructions from their immediate boss. In event of any emergency situation, there is always chaos and confusion at the site of the incident, as order/instruction comes from different heads of emergency management bodies, because no agency is in charge.

2. **Insincerity on the Part of the Government to Provide Emergency Services.**

The insincerity on the part of the government to provide functional emergency services especially at state and local government levels has hampered the management of the risks associated with building collapse, ravaging various parts of the country. The studies by Dynes (2006) and Bob (2008) have shown that the decentralization of emergency activities bring about better and a more efficient service delivery.

In Nigeria, there is an obvious absence of functional emergency management in most of the 36 states and the774 local governments (Adefisoye, 2015). It is important to note that in 2012, June 12th when the 50 years old Abakpa –Nike bridge in Enugu State collapsed under the heavy weight of rainfall: an accident that made commuters to remained stranded for several hours, before the Enugu State Government mobilized a private company to the site (Onwubiko, 2012).

In the South West region of the country, apart from Lagos Emergency Management Agency LASEMA) which is highly rated in terms of organizational effectiveness and others like Ekiti, Osun and Oyo which in recent times have made tremendous efforts to ensuring a variable disaster management, other states (Ondo and Ogun) appeared to have gone to sleep (Adefisoye, 2015). It is worrisome to note that states like Edo, Cross River, Rivers and Kano, are yet to statutorily recognized SEMAs (NEMA, 2013). The problem of disaster management and response initiative in the country is worst at the local government level.

The 774 Local Government Areas have become dysfunctional, majorly because of the undemocratic tendencies of state governors that have largely failed to respect Section 7 of the 1999 Constitution by ensuring that democratic structures are institutionalized in the grass root level (Onwubiko, 2012).

3. **Lack of Adequate Funding and Equipment**

Prompt and adequate funding are essential factors that would determine the effectiveness and efficiency of any organization. In addition, for an emergency management agency, a huge financial support is needed for the acquisition of up-to-date equipment and technologies to predict detect and mitigate disasters especially natural ones. The agency needs to be adequately funded and equipped with modern search and rescue paraphernalia, efficient communication gadgets and reliable transport facilities. Also, for building human capacity, good funding is needed. But in Nigeria, it is rather unfortunate that the government does not place premium on these (Adefisoye, 2015). In the case of NEMA, poor funding has been a major cog in the wheel of progress, and has hindered its performance due to poor funding. For instance, Salem (2008) pointed out that "the emergency problem is attributed to the failure of governance". He remarked that: On January 18, 2008, the Director General of NEMA, Air Vice Marshal Audu Bida told the Senate Committee on Federal character that the federal government was owing the agency N9.4 billion of un-remitted ecological funds, which would have gone a long way to acquire a warehouse of emergency equipment. The Director General said further that: "In 2007 the agency was to receive N4.7 billion, but unfortunately, we got nothing". That is a clear indication of the extent of neglect by the government to the emergency management in the country.

4, Poor Attitudinal Disposition of Nigerians towards Emergency Situations

Another serious problem confronting the management of building collapse risks is the poor attitudinal disposition of Nigerians towards emergency situations. The general attitudinal dispositions of nonchalance, despondency, cynicism, mistrust, and despair by Nigerians towards government establishments, and in particular, emergency situations are worrisome (Adefisoye, 2015). He stated further that, majority of the people at emergency sites/scenes only go there to catch a glimpse of event and even in some cases, they go there to loot and take advantage of the helpless victims. At times, the emergency managers and other rescue workers have been at the receiving ends of hostilities at emergency scenes especially in yhe

face of poor performance and inefficiency in service delivery, even when these inefficiencies are apparently unavoidable due to inadequate manpower, skills and materials.

5. Perceive of Disaster occurrence as "the wrath of the gods"

As a result of extreme cultural beliefs and primordial sentiments, disaster occurrences are perceived as "wrath of the gods" especially in the face of a perceived forceful and unjust possession of lands, corruption, injustice, sacrilege, and taboo.. This is unlike the case of advanced countries like the United States and other developed countries, where emergency response is often and adequately done by the concerted efforts of the people who are resident at such emergency locations, even before the arrival of emergency authorities/agencies. They see such as an opportunity for patriotism and genuine nationalism, also, an avenue to contribute their quota to the advancement of their country (Adefisoye, 2015).

6. Absence of Disaster Training Platforms

The absence of disaster management training platforms for Nigerians to acquire the necessary knowledge that would aid emergency responses contributes to the problem of their poor attitudinal dispositions. The effective management of disasters is not solely the function of government and its agencies which are assigned to undertake such task. As a result, governments especially in developed countries have instituted programmes so as to develop the know-how of emergency management in the populace. For instance, in US alone, there are over 180 schools with emergency related programmes (Bob, 2008). In the case of India, there is an emergency training Institute, Aniruddha's Academy of Disaster Management (AADM), a non-profit organization located in Mumbai India, with "Disaster Management as its principal objective". The basic aim of AADM is to save lives and properties in the event of disaster, be it natural or man-made. It has successfully trained 60, 000 citizens, the Disaster Management Volunteers (DMVs) to handle various disasters and disaster situations effectively (Times of India, August 2010.)

7. Bureaucratic Bottlenecks in Obtaining Emergency Assistance

The procedure of obtaining worthwhile emergency assistance from the agencies are too cumbersome, bureaucratic and not 'emergent' enough (Adedeji, 2013). For instance, in event of fire outbreak, the Nigeria Fire Service may give the excuse of no water, vehicle breakdown, etc, for their failure to respond to the distress call. In the case of NEMA, SEMA

and LEMA, the officer to authorize the movement of rescue equipment to the disaster location may not be on seat. This sometimes discourages the victims from seeking assistance from emergency agencies.

8. Lack of or ineffective Disaster Management Information System (DMIS)

There is need to create a disaster Management Information System (DMIS). According to Gupta (2001), preparing a template for disaster management including the following seven issues

a. Database: On various resources, skills, and services required for relief at short notice. It will have information on safety equipments and various other equipments, skills and other information required to deal with emergency.

b. Logistics: One of the most difficult problems to be handles is the organization of supply chain relief. There is the need, therefore to put all elements of logistics in place for tracking the supplies and distribution of relief materials.

c. Technological Needs: Whole range of technical questions regarding buildings, rescue and relief always emerge during emergency. The best practices have to be put in use.

d. Self Reliance: The lessons of community self-help need to be put together. A database of volunteers who can move at short notice, need to be developed.

e. Communication infrastructure: This could pose a serious problem during emergency. It will require a network of harm radios, use of radio stations, setting up of help lines, etc. There is also the need to create information dissemination system and develop mechanism for capacity building.

f. Emergency Preparedness: There is need to organized drills to keep society prepared for dealing with emergencies. Those living in fragile areas, especially along major river channels need to regularly inform about the hazards of living in such areas.

g. Forecasting: Wherever possible, disasters which can be anticipated overtime or space need to be looked into.

9. Lack of Collaboration among emergency management agencies and other stakeholders

The agencies lack collaboration among themselves and other stakeholders in emergency management. Collaboration among all the stakeholders in emergency management will

enhance effective and efficient performance as necessary assistance would be rendered during emergency situations. In this regard, NEMA can approach some of the multinational companies, the Engineering Unit of the Nigerian Armed Forces and other stakeholders for heavy equipment such as excavators, bulldozers, etc to enable them rescue trapped victims in event of building collapse. Adequate collaboration among all the stakeholders in the emergency management will ensure efficient service delivery in Nigeria.

2.3.8 Impact of Building Collapse Risks on building development in Nigeria

The collapse of a building has tremendous effects that cannot be easily forgotten by any of its victims. The consequences are usually in the form of economic and social implications, and they include loss of human lives, injuries, economic waste in terms of loss of properties, investments, jobs, incomes, loss of trust, dignity and exasperation of crises among the stakeholders and environmental disaster (Ede 2010).

The complete quantification of the effects of any collapse is extremely difficult, as there are so many factors involved which include emotional and subjective factors. Apart from the number of deaths that can often be truly identified, the rest of the effects are surrounded by so many uncertainties which make analysis only approximate. Putting aside the quantifiable economic sums, the stress, trauma and shocks may have far-reaching effects upon the building owner and /or employees, occupants and others involved in one way or the other with the structure (Ede, 2010).

More so, various site of building collapse scattered across the length and breadth of Nigeria is making the environment unhealthy as such collapsed buildings has become hideout for hoodlums, touts etc. Dangerous animals like snakes have also made such buildings their place of abode, which is a danger.

Obodoh, et al (2019) in their study on assessment of the effects of building collapse risks on the stakeholders in the Nigerian built environment observed that the negative effects of these risks include loss of lives, loss of property, loss of reputation and integrity of the contractors, legal tussle among the stakeholders, etc.

Oke (2011) carried out a research on the Causes and Effects of building collapse in Nigeria and identified the following as the consequences of building collapse. Apart from loss of

lives (mostly innocent citizens), many other people have been rendered permanently disabled in one form or the other as a result of increasing rate of building collapse. Other consequences include: i. Economic losses ii. Loss of countless properties iii. Creates unhealthy environment iv. Hideout for hoodlums and places of abode for dangerous animals like snake

The researcher is in total agreement with Ayodeji (2011) on the consequences of building collapse in Nigeria.

Nwafor (2015) in his study identified the reputational effects building collapse on Nigerian building industry to include: de-market of the values and integrity of on building professionals, portray Nigerian building industry as being corrupt and professionals' marketability to foreign firms/clients has been devalued. The researcher agrees with Nwafor (2015) on the reputational effect of building collapse on Nigerian construction industry considering the spate of building collapse in Nigeria and the attendant losses.

Janssens, Dermot and Marios (2010) in their study on building failure consequences classified the consequences resulting from a building failure into three groups: economic, human and environmental consequences (Table 2.4)

Table 2.5: Classification of Building Failure Consequences

Human	Economic	Environmental
Injuries	Replacement/repair of structure	CO_2 Emissions
Fatalities	Replacement/repair of contents	Energy use
Psychological damage	Loss of functionality/production	Toxic releases
	Temporary relocation	Environmental Studies/Repair
	Rescue costs	
	Regional economic effect	
	Investigation/compensation	
	Loss of reputation	

Source: Janssens, Dermot and Marios (2010).

They stated that difficulties may arise when trying to compare different types of consequences. For example, in order to compute an overall 'failure cost', one may wish to assign monetary values to the different consequences (fatalities, injuries, CO_2 emissions etc), which could then be used as part of a cost benefit analysis. But, this may not always be the most suitable approach especially if the environmental or human consequences are significant.

Dimuna (2010) stated in his study, that the incidences of building collapse witnessed in the country in the recent years has resulted in the loss of many lives and destruction of properties worth several millions of naira. Many families have been traumatized and many developers have lost their life investments.

According to Olumide (2012), the consequences of building collapse can be summarized as:

1. Loss of lives
2. Loss of money invested
3. Material wastage
4. Loss of prestige of the owner
5. Loss of reputation of the contractor
6. Loss of the buildings' aesthetic values
7. Increase in the cost of maintenance
8. Leads to shortage of manpower
9. A great loss to the economy

Adebowale et al (2016) in their study identified that the effects of building collapse are usually in the form of economic and social implications which include:

i. Loss of human life ii. Loss of materials

iii. Loss of capital investments iv.

Physical damage and psychological

trauma.

Chendo and Obi (2015) identified the following as the consequences of building collapse in Nigeria and they include:

i. loss of life property and huge sum of capital ii. loss of

reputation and integrity leading to psychological trauma iii.

Loss of new commissions and contracts iv. Withdrawal of

practicing licenses

v. Loss of materials and capital investments

The above building collapse consequences as identified by Chendo and Obi (2015) are in agreement with Olumide (2012)

These researchers were able to identify some of the consequences of building collapse but none of the authors categorized the building collapse risk factors. That is one of the gaps this research intends to fill.

2.3.9 Impact of Building Collapse Risks in the Nigerian Economy

The negative impact of building collapse risks on the socio-economic development of our economy is obvious. Ede (2010) observed that many precious lives are lost and the nation looses the contributions that could have come from these victims towards the socio-economic growth of the nation. In addition, this increasing rate of death from building collapse in Nigeria runs against the United Nation Millennium Development Goals (MDGs) programs aimed at reducing the mortality rate and improving safety and life expectancy of the world population.

Obodoh, et al (2018) stated that building collapse risks have multifarious factors which they categorized as Economic/financial risks, Socio-Political risks, Human related risks, Physical risks, Environmental risks and Law/legal risks. From their study it ws found that human related risks have predominant effect in the Nigerian economy.

Akande, et al (2016) in their study identified the following as the effects of building collapse: Abrupt loss of lives and properties, Waste of properties, Discouragement of property development and Scarcity of property.

Windapo and Rotimi (2012) in their study on contemporary issues in building collapse and its implications for sustainable development opined that due to rate of building collapse in Nigeria, current construction practices are unsustainable and not in alignment with ideal sustainability principle.

Other impacts of building collapse risks in the Nigerian economy include:

1. Loss of the contributions from the victims towards the socio-economic growth of the nation.
2. Professionals marketability to foreign firms/clients have been devalued
3. Shortage of the supply of real estate facilities
4. Decrease in the contributions of real estate sector to the nation's GDP
5. Portrays Nigerian Building industry as being corrupt
6. Shortage of manpower
7. Discourages investment in property development
8. Leads victims to permanent disability

2.3.10 Building Collapse Risk Factors

The table below shows the appraisal of some related literatures to indicate building collapse risk factors that affect the stakeholders in the building industry and Nigerian economy as identified by some authors.

Table 2.6: Appraisal of some related literatures to indicate building collapse risk factors that affect the stakeholders in the building industry and Nigerian economy.

Authors	Study Areas	Building collapse Risk Factors
Akande,et al(2016)	Nigeria	- loss of lives and properties, - Waste of properties, - Discouragement of property development Scarcity of property

Windapo and Rotimi (2012)	Nigeria	- Loss of the contributions from the victims towards the socio-economic growth of the nation. - Professionals marketability to foreign firms/clients have been devalued - Shortage of the supply of real estate facilities - Decrease in the contributions of real estate sector to the nation's GDP - Portrays Nigerian Building industry as being corrupt - Shortage of manpower - Discourages investment in property development - Leads victims to permanent disability
Chendo and Obi (2015)	Nigeria	- loss of life property and huge sum of capital - loss of reputation and integrity leading to psychological trauma - Loss of new commissions and contracts - Withdrawal of practicing licenses - Loss of materials and capital investments
Adebowale et al (2016)	Nigeria	- Loss of human life - Loss of materials - Loss of capital investments - Physical damage and psychological Trauma
Olumide (2012),	Nigeria	- Loss of lives - Loss of money invested - Material wastage - Loss of prestige of the owner - Loss of reputation of the contractor - Loss of the buildings' aesthetic values - Increase in the cost of maintenance - Leads to shortage of manpower - A great loss to the economy

Dimuna (2010)	Nigeria	- Loss of many lives - destruction of properties - loss of life investments. - Shortage of manpower - Discourages investment in property development. - Leads victims to permanent disability
Nwafor (2015)	Nigeria	- De-market of the values and integrity of on building professionals, - Portray Nigerian building industry as being corrupt - Professionals' marketability to foreign Firms/clients have been devalued.
Janssens, Dermot and Marios (2010).	UK	- Replacement/repair of structure - Replacement/repair of contents - Loss of functionality/production - Temporary relocation - Rescue costs - Regional economic effect - Investigation/compensation - Loss of reputation - Psychological damage - Environmental Studies/Repair - Injuries
Oke (2011)	Nigeria	- Economic losses - Loss of countless properties - Creates unhealthy environment - Hideout for hoodlums and places of abode for dangerous animals like snake
Obodoh, et al (2019)	Nigeria	- loss of lives, - loss of property, - loss of reputation and integrity of the contractors, - legal tussle among the stakeholders
Ede 2010).	Nigeria	- loss of lives - Injuries - loss of properties, - Loss of investments, - Loss of jobs/incomes, - loss of trust, - exasperation of crises among the stakeholders

An extensive review of related literatures carried out uncovered sixty seven(67) building collapse risk factors affecting stakeholders in the building industry, building development and Nigerian economy: Akande, et al (2016), Windapo and Rotimi (20-12), Chendo and Obi (2015), Adebowale et al (2016), Olumide (2012), Dimuna (2010), Nwafor (2015), Janssen Demot and Marios (2010) Oke (2011) Obodoh et al (2019), Ede (2010), etc as shown in table 2.6.

The Table 2.7 shows the sixty seven (67) identified building collapse risk factors that affect the stakeholders in the building industry, building development and Nigerian economy.

Table 2.7: Sixty Seven (67) identified building Collapse Risk Factors affecting Stakeholders, Building development and Nigerian Economy

1. Loss of property
2. Psychological trauma and shocks
3. Loss of new commission and contracts
4. Loss of reputation and integrity of the contractors
5. Withdrawal of practicing licenses
6. Loss of trust
7. Loss of annual income/capital investment
8. Loss of materials
9. Bankruptcy of investor or developer
10. Decrease in the contribution of real estate sector to the nation's development
42. Leads victims to permanent disability
43. Psychological damage (fear, helplessness, distress, depression and suicides)
44. Disruption of economic activities
45. Reduction in the energy use
46. Increase in toxic emission
47. Environmental studies/repair
48. Loss of building aesthetic values

49. Degrading of the environment

50. Loss of strength of the building

11. Loss of lives
12. Injuries
13. Disruption of educational activities
14. Loss of contributions from the victims towards the socio-economic growth of the nation
15. Increase in death rate against United Nation's Millennium Development Goals (MDGs)
16. Provides hideouts for robbers and hoodlums
17. Place of abode for dangers animals like snakes
18. Environmental damage
19. Loss of functionality in the neighbourhoods
20. CO_2 Emissions/Pollution
21. Structural damage
22. Damage to contents
23. Replacement/repair of structure
24. Replacement/repair of contents
25. Temporary relocation
26. Exasperation of crises among stakeholders
27. Legal tussle among stakeholders
28. Arbitration/mediation to resolve crises arising from building collapse
29. Conflicts resolution
30. Apportioning blames and arbitrary words of mouth among stakeholders
31. Loss of life investments
32. Increase in the cost of maintenance
33. Shortage in the supply of real estate facilities
34. Clean up costs
35. Rescue costs
36. Discourages investments in property development
37. Loss of jobs
38. Scarcity of property
39. Loss of prestige of the owner

40. Shortage of manpower 41. De-marketing the values of industry professionals
51. Increment of sick citizens 52. Street blockage 53. Evacuation difficulty 54. Travel distance increment 55. Damage of materials beyond re-use 56. Loss of fauna and flora 57. Portrays Nigerian Building Industry as being corrupt 58. Professionals marketability to foreign firms/ Clients has been devalued 59. Cost of investigation/Compensation 60. Treatment of the injured people 61. Cost of rebuilding/repair 62. Cost of loss of functionality 63. Cost of replacement/repair of its contents 64. Cost of temporary relocation 65. Regional economic effects 66. Waste of resources, time and labour 67. Cost of legal dispute

Content Analysis was performed on all the sixty seven (67) identified building collapse risk factors in order to reduce them to a considerable number to be used in the research and to eliminate collinearity between them. They were clustered in their similarities as shown in Table 2.7.

Table 2.8: Clustering of the sixty seven (67) identified Building Collapse Risk Factors affecting Stakeholders, building development and Nigerian economy

S/No	**Structural factors**	**Non-adopting factors**

1	Loss of property Loss of annual income/capital investment Decrease in the contribution of real estate sector to the nation's GDP Loss of life investment Increase in the cost of maintenance Shortage in the supply of real estate facilities Clean up costs Rescue costs Cost of investigation/compensation Treatment of injured people Cost of rebuilding/repair Cost of loss of functionality Cost of replacement/repair of its contents Cost of temporary relocation Regional economic effects Waste of resources, time and labour Cost of legal dispute	Economic/Financial Risks
2	Loss of reputation and integrity of the contractors Psychological trauma and shocks Loss of new commission and contracts Withdrawal of practicing licenses Loss of trust Discourages investment in property development Loss of jobs Scarcity of property Loss of prestige of the owner	Socio-Political Risks

	Shortage of manpower De-marketing the values of industry professionals Portrays Nigerian building industry as being corrupt Professional's marketability to foreign firms/clients has been devalued	
3	Loss of lives Injuries Disruption of educational activities Loss of contribution from victims towards the socioeconomic growth of the nation Increase in death rate against the United Nations Millennium Development Goals (MDGs) Leads the victims to permanent disability Psychological Damage (fear, helplessness, distress, depression and suicides) Disruption of economic activities	Human Related Risks
4	Provides hideouts for robbers and hoodlums Place of abode for dangerous animals like snake Environmental damage Loss of functionality in the neighbourhoods CO_2 Emission/Pollution Reduction in the energy use Increase in toxic emission Environmental studies/repair Loss of building aesthetic values Degrading of the environment	Environmental Risks
5	Structural damage Damage to contents Loss of functionality Replacement/repair of structure	Physical Risks

	Replacement/repair of contents	
	Temporary relocation Loss of strength of building Increment of sick citizens Street blockage Evacuation difficulty Travel distance increase Damage of materials beyond re-use Loss of fauna and flora	
6	Exasperation of crises among stakeholders Legal tussle among stakeholders Arbitration/Mediation to resolve crises arising from building collapse Conflicts resolution Apportioning of blames and arbitrary words of mouth among the stakeholders	Law/Legal Risks

Cluster analysis which is one of the data analysis tool is employed to carry out the analysis. The purpose of this tool is to group similar objects into respective categories. It is also aimed at sorting different objects into groups so that the degree of association between two objects is maximal if they belong to the same group and minimal otherwise.. Cluster analysis was carried out (results shown in chapter four) to determine the decision variables for the proposed framework for management of building collapse risks in Nigeria.

2.3.11 Disaster/Emergency Management

Disaster management according to Omotosho (2010) is defined as those measures which are aimed at impeding the occurrence from having effects on communities. This definition simply narrows emergency management down to the role of mitigation which just a meager part of the entire activities associated with emergency management. However, the activities that surround the overall framework of emergency management go beyond this. It is pertinent to state that emergency management includes a network or a body policy or policies which regulate the operation of emergency management bodies. For instance, Gabriel (2002), observed that Australia Emergency Agency (EMA) does not respond directly to emergencies. Rather, as an agency of commonwealth, it provides resources, finances, training and research. According to him, Australia delegates responsibility for emergency management to individual states and territories. It has only been recently that Australia has begun to focus on prevention and mitigation measures, thereby moving away from the relief-giving and response centric to mitigation and preparedness approach.

According to Agagu (2010), emergency management requires ability to anticipate, preparedness skills in acting with dispatch and effective skills in coordinating the efforts of the various institutions, professionals, actors and stakeholders" These no doubt are the major features of a modern emergency management system. Firstly, the advancement in technology has made it possible to predict, and determine the gravity of natural disasters like earth quake, thereby giving room for effective evacuation of residents of such area. Secondly, since the task of managing disaster occurrences has gone beyond the responsibilities of a constituted emergency management authority/agencies, but require concerted efforts by all stake-holders including the 'social capital' of such area, there is the need for effective coordination of such activities so as to fully maximize such.

. Oruonye (2012) affirms that "disaster management is the process of addressing an event that has the potential to seriously disrupt the functioning of a society. He stated that Disaster management is similar to disaster mitigation; however it implies a whole of government approach to using community resources to fight the effects of an event and assumes the community will be self sufficient for periods of time until the situation can be stabilized. Disaster management can help minimize the risks of flood disaster through early warning, provide developmental plans for recuperation from the disaster, generate communication and medical resources, and aid in rehabilitation and post disaster reconstruction.

According to the United Nations Development Programme (2005), Disaster management is the body of policy, administrative decisions and operational activities required to prepare for,

mitigate, respond to, and repair the effects of natural or man-made disasters such as building collapse. Indeed, disaster management has to do with a full range of activities that are done in security and natural hazard events.
Also, disaster management is the coordination and integration of all activities necessary to build, sustain, and improve the capability to prepare for, protect against, respond to, and recover from threatening or actual natural or human-induced disasters (NDMF, 2010).

Also, on the overall role of an emergency management agency/organization, Oruonye (2012) states that "The role of any disaster management authority all over the world is to regulate, coordinate, develop systems and train technical manpower for disaster management".

It is as a result of this that the federal government of Nigeria for example established National Emergency Management Agency (NEMA) under Degree 12, with the broad mandate of coordinate the management of disasters in the country.

Likewise, in Russia, during the world War, the country had a strong emphasis on civil protection because of the threat of nuclear attack from the U.S. Nuclear fall-out shelters and evacuation procedures were emphasized because of the immediate crisis and threat of mutual destruction (Porfiriev, 1999). As world War hostilities dissipated, Russia began to produce legislation to revamp emergency management. This is in total realization by the Russian government realized that effective emergency management required a structured, developed system. Russia is now integrating additional mitigation and preparedness measures into their programs, thus becoming more pro-active than reactive in their strategies (Porfiriev, 1999).

Agagu (2010) also states that, emergency management can be defined as the process of developing and implementing policies that are concern with:

Mitigation – Deciding what to do, where a risk to the health, safety, and welfare of society has been determined to exist; and implementing a risk reduction program;

Preparedness – Developing a response plan and training first response to save lives and reduce disaster manager, including the identification of critical resources among responding agencies, both within the jurisdiction and with other jurisdiction,

Response – Providing emergency aid and assistance, reducing the probability of secondary damage, and minimizing problems for recovery operations; and

Recovery – Providing immediate support during the early recovery period necessary to return vital life support to minimum operation levels, and continuing to normal.

Omotosho. (2010) opines that disaster management encompasses a body of policies, regulations and operational activities undertaken to deal with disasters. He stressed that disaster management involves the classical management functions of planning, organizing, staffing, leading and controlling. According to him, planning refers to the idea of outlining the things that have to be done concerning the control and prevention of disaster. It also concerns the methods to be employed for doing them in order to achieve set objectives with the greatest efficiency. Organizing has to do with the setting out of the formal structure of authority and flow of people in such a way that the task is carefully arranged, clearly defined and effectively coordinated to accomplish the goal desired. Staffing has to do with devising an efficient and effective system through which the staff that will do the job will be recruited, trained and well taken care of to give in their best towards achieving the goals of effectively managing disaster. Directing or leading refers to the continuous task of making decisions, embodying them in specific and general instructions and setting the pace by the leadership. Controlling simply refers to ways of coordinating the activities to ensure smooth and harmonious working relationship which can guarantee efficiency and effective disaster management.

It is important to state that disaster management aims at motivating societies at risk to be more involved in the conscious management of risk and reduction of vulnerability in various communities (Omotosho, 2012). As a cross cutting issue, it demands substantial commitment from public authorities/ Civil society and a greater inter-sectoral and policy coordination at all level.

2.3.12 Disaster Management in Nigeria

Disaster Management in Nigeria predates independence, with the establishment of the Fire Brigade in 1906. The agency was merely responsible saving lives and properties, and providing humanitarian services during emergencies. However, in 1960s and 1970s, it was replaced with ad hoc arrangements domiciled in the office of the Head of State and State Governors. During this period, disaster responses were considered as mere security issues. Events however took a turn with the devastating effects of the 1972/73 drought. The drought had serious effects on lives, properties and the economy. Consequent upon this, the National Emergency Relief Agency (NERA) was established with the overall mandate of administering relief materials to disaster victims. In order to address natural disaster reduction strategies in line with the UN International Decade for Disaster Reduction (IDNDR), and at the same time address the limited scope of NERA, the Federal Government

in 1990 set up an Inter-Ministerial body. Consequently and to meet the demands of managing disasters, the FGN in 1993 decided to raised the status and expand the scope of NERA as an agency under the Presidency.

In 1997, the management of NERA organized a National Workshop that involved major stake holders in Disaster Management in Nigeria to deliberate on critical factors for an effective disaster management system in Nigeria, and noted the need to:

i) Expand the functions of NERA, amend the decree setting up NERA and change its name to National Emergency Management Agency (NEMA).

ii) Structure the new Agency by putting into consideration appropriate policies and strategies: Search and Rescue mobilization capacities; Information; Education; and Preventive strategies; Administrative; Finance and Logistics systems; Relief and Rehabilitation capacities; Research and Planning. iii) Provide appropriate budgetary allocation for the operation of the agency.

(NDMF, 2001)

The acceptance of these recommendations by the FGN led to the establishment of NEMA in March 1999 under Act 12 under Act 12 of 1999 as amended by Act 50 of 1999 to manage disaster in all forms and ramification (NEMA, 1999)

In fulfilling its mandate, NEMA developed several plans and guidelines and one of the guidelines is the National Disaster Management Framework (NDMF).

2.3.13 Management of Building Collapse Risks under the National Disaster Management Framework (NDMF)

The NDMF was designed to form the bedrock for the overall Disaster Management activities in Nigeria, the principle of shared responsibility and the need to ensure proper integration and collaboration among stake holders. (NDMF, 2001). Other articles of the framework include:

1. There shall be National Emergency Management Agency (NEMA) at the Federal level, State Emergency Management Agency (SEMA) at the state level, and Local Emergency Management Agency (LEMA) at the local government level. This to a large extent shall strengthen the capacities of the Federal, State and Local Government to reduce the likelihood and severity of disasters.

2. Every tier of government shall build the capacity of their agencies to prepare for, prevent against, response to and recover from disaster events.

3. Federal, State and Local government, Departments and Agencies (MDAS), the military, police, Para-military and Civil Society Organizations (CSOs) shall develop their capacities in disaster management capabilities as first responders, and Emergency Management Volunteers (EMVs) shall be established to compliment the organized structures. Disaster Management Units (DMUs) shall be established in different military formations across the country to provide assistance to civil authority during emergencies.

The NDMF also specifies the responsibilities of each stake holder in Disaster Management in Nigeria. They are:

The Federal Government through the National Emergency Management Agency (NEMA) shall by this policy perform the following disaster management functions:

i. Formulate policy on all activities relating to disaster management in Nigeria and coordinate the plans and programmes for efficient and effective response to disasters at national level.

ii. Monitor the state of preparedness of all organizations or agencies which may contribute to disaster management in Nigeria.

iii. Collate data from relevant agencies so as to enhance forecasting, planning and field operations of disaster management.

iv. Educate and inform the public on disaster prevention and control measures.

v. Coordinate and facilitate the provision of necessary resources for Search and Rescue and other types of disaster curtailment activities in response to distress calls.

vi. Coordinate the activities of all voluntary organizations engaged in emergency relief operations in any part of the Federation.

vi. Receive financial and technical aid from international organizations and non-governmental agencies for the purpose of disaster management in the country.

vii. Collect emergency relief supply from local and foreign sources and from international and nongovernmental agencies (NEMA, 1999)

The Roles of the State Government

The NDMF stipulates that all states in the Federation shall ensure the establishment of a body to be known as State Emergency Management Agency (SEMA) backed up by State Legislation. The legislation shall include provisions that will ensure that local Governments in the State also establish authority with similar functions.

The State Government through the State Emergency Management Agency (SEMA) shall by this policy perform the following disaster management functions:

i. Formulate policy on activities relating to disaster management in the state;

ii. Co-ordinate plans and programmes for efficient and effective response to disaster management;

iii. Monitor and provide feedback to NEMA on the state of preparedness of all organizations and agencies which may contribute to disaster management within the State; iv. Educate the public on disaster and control measures within the state;

v. Work closely to LEMA for distribution of relief materials to disaster victims;

vi. Co-ordinate and facilitate the provision of necessary resources for search and rescue operations and other types of disaster curtailing activities within the state.

The roles of the Local Government

The NDMF stipulates that the Local Government shall put in place a legislation establishing a disaster management body to be known as Local Emergency Management Authority (LEMA). Under framework LEMA shall perform the following functions:

i. Coordinate disaster management activities and response to disaster events in local government area.

ii. Monitor and provide feedback to SEMA on the status of preparedness of all organizations and agencies which may contribute to disaster management within the Local Government Area.

iii. Collect and collate data on disaster and disaster risk areas in their respective Local Governments, and same with SEMA. iv. Mobilize support and resources from the SEMA when damages and need assessments are considered beyond the capacity of the Local Government to respond.

v. Establish and development Disaster Management capacity of community structures.

Other stake holders include Neighbourhood associations, schools, Community Based Organizations (CBOs), Faith Based Organizations (FBOs) and Disaster Reduction Groups (DRGs). The overall function of these groups is to provide support for emergency management activities at the grass root level.

primary objectives are to coordinate other relevant stakeholders to wake up to their responsibility.

The Decree No. 12 of 1999, which established NEMA, charged the agency with broad mandate to coordinate and control the management of disasters in the country. NEMA is meant to coordinate the activities of other bodies like Federal and State Fire Service, Nigeria Civil Defense, State and Local Government emergency management bodies (SEMA and LEMA), the Engineering Unit of the Nigerian Armed Forces, Civil Society, and other stakeholders. However, the poor response to various emergency cases in Nigeria, especially the Synagogue building collapse in Lagos (2014), Lekki building collapse (2016), 2011 and 2012 flood incidents point to evidences of poor coordination. NEMA is not exercising the powers given it by the Decree No.12 of 1999 to coordinate and control the activities of other agencies or stakeholders in emergency management in this country. Every agency appears to be waiting and taking instructions from their immediate boss. In event of any emergency situation, there is always chaos and confusion at the site of the incident, as order/instruction comes from different heads of emergency management bodies, because no agency is in charge.

2.4 Critical Success Factors for management of building Collapse Risks in Nigeria

Critical success factor can be described as a term or an element that is necessary for an organization or project to achieve its mission. It is a critical factor or activity required to ensure the success of a company or an organization (Wiki, 2014). Critical success factors are those few things that need to be added to ensure success for a manager or an organization.

They therefore, represent those managerial or enterprise area that must be given special and continual attention to bring about high performance

In managing building collapse risks, prompt availability of relevant information to the right people is the decisive factor for the management of any emergency situation, particularly during the critical early post incident stages (Comfort, Sungu, Johnson and Dunn 2001). It is worthy to note that prompt and appropriate information is especially crucial in search and rescue of people trapped in the rubble of collapsed building (Coburn and Spence 2002). There are primarily three mainstream search methods and tools:

1. Physical Search – Consisting of visual and vocal search in combination with systematic movement across the site and conducting interviews with survivors.
2. Canine Search – Victim search using air-scent sniffer dogs. Specially trained dogs are along with the physical search, the most common and reliable aid for locating trapped people.
3. Electronic Search – Victim search using electronic devices

These three primary types of search will allow search personnel to focus on the most important potential rescue opportunities.

The critical success factors for managing disasters as contained in the National Disaster Management Framework (NDMF, 2001) include:

2.4.1 Establishment of functional lines of communication amongst stakeholders.

These shall include:

i. developing relationship with relevant media stakeholders.
ii. Developing a database (telephone numbers, e-mails and contact addresses) of focal agencies and persons and integrating it into National, State and Local Databanks in NEMA, SEMA and LEMA respectively.
iii. Developing a database of available equipment that can be used for disaster management.
iv. Monitoring and updating information on state of preparedness of stakeholders.
v. Developing MOUs and having mutual understanding with stakeholders on their participation and deployment of their equipment during emergencies.

vi. Establishing affordable, accessible and secured Emergency Call Centers (ECCs) at all levels of government.

vii. Identifying effective communication facilities, including close user group and Nigeria police radio-net for long range communication. viii. Liaison with telecommunication network providers for use of their cell broadcast facilities.

ix. Updating database regularly.

2.4.2 Establishment of relationship with stakeholders and sharing common understanding on problems and solutions.

These shall include:

i. Identifying stakeholders that are relevant to disaster management.

ii. Appointment of disaster management desk officers in stakeholders 'institutions.

iii. Organizing regular meetings between and among disaster management stakeholders to share experience and review strategies.

iv. Conducting workshops, seminars and training programmes for stakeholders capacity development.

v. Conducting regular public awareness, advocacy and education programmes.

vi. Conducting VCA to determine hazards, vulnerabilities and community coping capacities vii. Conducting contingency planning and developing Contingency Plans viii. Building scenarios and conducting regular simulation exercises among stakeholders.

ix. Identifying and recruiting volunteers at all levels and building their capacity for disaster management.

x. Publishing periodic reports on hazards, vulnerabilities and disaster management activities within their areas of jurisdictions.

xi. Reviewing plans, programmes and strategies regularly.

2.4.3 Adequate Funding and Monitoring of the Activities of all Emergency Management Agencies

Prompt and adequate funding are essential factors that would determine the effectiveness and efficiency of any organization. In addition, for an emergency management agency, a huge

financial support is needed for the acquisition of up-to-date equipment and technologies to predict detect and mitigate disasters especially natural ones. Also, for building human capacity, good funding is needed. But in Nigeria, it is rather unfortunate that the government does not place premium on these (Adefisoye, 2015). In the case of NEMA, poor funding has been a major cog in the wheel of progress, and has hindered its performance due to poor funding. Adequate will ensure the effective performance of the emergency management agencies in the country. Also, the activities of the agencies require proper monitoring so as to ensure that when funds are provided, they are not misappropriated and that the agencies are responsive to their duties.

2.4.4 Establishment of Functional Disaster Management Institutions at all Levels of Governance

The government should establish functional disaster management institutions at all levels of governance, at federal, state and local governments/all levels of governance to prepare for, prevent, mitigate, respond to and recover from disaster events in Nigeria. There shall be National Emergency Management Agency (NEMA) at the Federal level, State Emergency Management Agency (SEMA) at the state level, and Local Emergency Management Agency (LEMA) at the local government level. This to a large extent shall strengthen the capacities of the Federal, State and Local Government to reduce the likelihood and severity of disasters. Every tier of government shall build the capacity of their agencies to prepare for, prevent against, response to and recover from disaster events. Federal, State and Local government, Departments and Agencies (MDAS), the military, police, para-military and Civil Society Organizations (CSOs) shall develop their capacities in disaster management capabilities as first responders, and Emergency Management Volunteers (EMVs) shall be established to compliment the organized structures. Disaster Management Units (DRUs) shall be established in different military formations across the country to provide assistance to civil authority during emergencies.

2.4.5 Develop the Capacity of Relevant Institutions and Stakeholders

An effective institutional arrangement is essential for managing disasters successfully. While a principal responsible unit must be specified, other units should be specified at various levels including provincial, district and village level. Unclear line of authorities, coupled with a

slow decision making process caused delays in activities (Moe and Pathranarakul, 2006).These units should be fully authorized for disaster management and have developed a disaster management master plan. It will be imperative to develop the capacity of all relevant institutions and stakeholders at all levels of governance to prepare for, prevent, mitigate, respond to and recover from disaster events in Nigeria.

2.4.6 Monitor the State Preparedness of all Organizations and Agencies

The state of preparedness of all organization and agencies charged with the responsibilities of managing disaster in should be adequately monitored to ensure that they are living up expectations. Any form of negligence of duties by any agency should be visited with appropriate sanctions. A monitoring team should be put in place to monitor all organizations and agencies saddled with the responsibilities of managing building collapse risks to ascertain the state of their preparedness for emergency situations.

2.4.7 Establishment of Disaster Management Volunteers in both Rural and Urban areas

In other to ensure a wholesome management of disaster in this country, there is the need of establishment of disaster management of volunteers in both rural and urban centers to compliment the activities of government agencies and non-governmental organizations. These volunteers will always be on hand to handle emergency situations before the arrival of the government agencies. They are can also serve as informants to the government agencies and provide necessary assistance to the victims building collapse.

2.4.8 Prompt and Appropriate Assistance to Victims of Building Collapse

The effective management of building collapse requires prompt and appropriate assistance to victims of building collapse. This will ensure reduction of losses to the victims, both loss of lives and property. Therefore, the emergency management agencies should be responsive to their duties and be ready to come to the rescue of disaster situations in the country. Any form of delay or negligence of duties will jeopardize or mare the goals of effective management of disaster in this country.

2.4.9 Coordinate and Support the Activities of NGOs Engaged in the Management of Building Collapse

To ensure that the activities of the NGOs engaged in the management of building collapse yield the desired results, coordination and support are very imperative. The support could be in form of financial, manpower or provision of necessary equipment in emergency situations. With NGOs and other agencies, the challenges of managing building collapse risks will record the desired success.

2.4.10 Establishment of collaborative network of all the stakeholders.

To ensure effective and efficient service delivery in the management of building collapse risks in Nigeria, collaboration among the stakeholders is of essence. No agency can boast of having all the required staff and equipment meant for handling disasters, but with collaboration among the stakeholders, necessary assistance could be sought from sister organizations. This will in turn lead to good service delivery in event of emergency situations in the country.

These critical success factors (CSFs) below are consistent and supported with the findings of Adefisoye (2015), Essoh and Abutu (2018), Adio-Moses and Taiwo (2019) and Oruonye, Ahmed and Tukura (2016).

The eight resulting CSFs include:

1. Establishment of functional disaster management institutions at all levels of governance

2. Adequate funding of emergency agencies

3. Develop the capacity of relevant institutions and stakeholders

4. Monitor the state of preparedness of all organizations/agencies

5. Establishment of disaster management volunteers in both rural and urban areas

6. Prompt and appropriate assistance to victims of building collapse

7. Establishment of collaborative network of all the stakeholders

8. Coordinate and support the activities of NGOs involved

2.4.11 Conceptual Framework

The conceptual framework defines the important concepts that predicate this research. The conceptual framework of this study depicts the building collapse risk factors as independent variables and management of building risks as dependent variable. It goes further to outline the moderating variables on the key variables under study. Figure 2.12 illustrates the conceptual framework of the research.

INDEPENDENT VARIABLES MODERATING VARIABLES

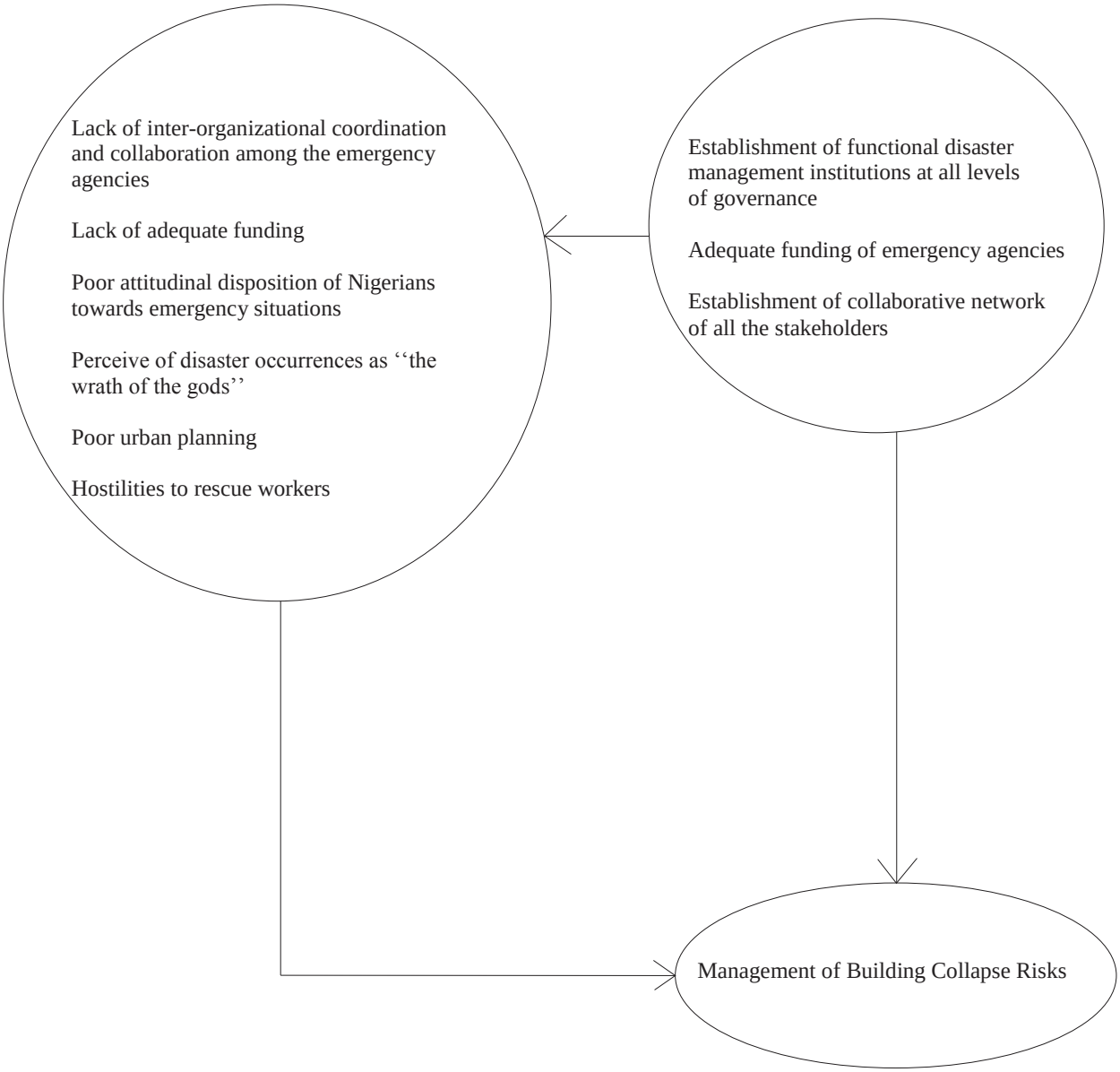


Fig 2.12: Conceptual Framework

2.4.12 Summary of Reviewed Literature

Building collapse is a phenomenon witnessed all over the world irrespective of the state of development of the construction sector of any nation. However, statistics suggest that developing countries such as Nigeria are more prone to such collapse compared to the more developed countries in the world. This would immediately suggest that there could be avoidable causes of building collapse prevalent in such countries which increase the likelihood of such occurrences. Thus, most of the incidences of building collapse in the developed world are as a result of unforeseen circumstances rather than professional negligence. On the contrary, Nigeria is still grappling with a host of issues including unqualified and poorly trained professionals and skilled workers, weak institutional controls and governance and quality issues around construction materials

The building collapse risks have some economic and social implications both to the stakeholders and the economy at large. The negative impact of building collapse on the socio-economic development of our economy is obvious. Whereas many precious lives are lost, the nation looses the contributions that could have come from these victims towards the socio-economic growth of the nation.

.Nigerian government has over the years came up with policies and programs to help mitigate /manage the risks associated with building collapse by establishing agencies responsible for the management of disasters such as building collapse, fire outbreak, flooding, etc. The management agencies (NEMA, SEMA, LEMA, Nigeria Fire Service, Red Cross Society, etc) have been bedeviled with a lot of problems like lack of adequate staff (professionals), lack of equipment, poor funding, etc. All these have resulted to poor management of the consequences of building collapse in the country.

2.3.13 Literature Gaps

1. Empirical Gap: There appears to be an empirical gap in the previous research (Bala 2017, Oloke et al 2017, Akande et al 2016, Chendo and Obi 2015, and Babalola 2015)

i. The previous research has focused primarily on qualitative research concerning building collapse and risks associated with building collapse. But this study focused on both qualitative and qualitative research.

ii. No study to date has directly attempted the empirically evaluate the management of building collapse risks from risk management perspective to expose their strengths and/or weaknesses. iii. There is no work that classified building collapse risks into major and sub-factors which this work has achieved.

2. Population Gap: Previous research has focused primarily on the populations of buildings that collapsed professionals in the built environment, number of injuries and recorded with little or no research on the population of inhabitants of the collapsed buildings who actually feel the pains.

3. Methodological Gap: The research identified a methodological gap in the previous research. While the previous researchers focused more on their regions, this study viewed building collapse across the globe both developed and developing economies to identify the building collapse risks and the consequences on the stakeholders (Miles, 2017)

CHAPTER THREE

METHODOLOGY

3.1 Research Design

The research design adopted for this study is the survey research design. This design was adopted because it allows for the observation and description of variables in their natural settings without manipulation. The design was used to generate the data requirements for the study which include; Building collapse risks identification, Analysis of building collapse risks, Assessment/management of building collapse risks and problems confronting the management of building collapse risks.

3.2 Area of Study

The study was carried out in the five selected cities of Nigeria and the cities are Abuja, Ibadan, Lagos, Owerri and Port Harcourt. The study focused on the key stakeholders involved in the execution of public and private building projects in the Cities. The cities were chosen based on the concentration of building construction activities in the area, population pressure and rate of building collapse. Odeyemi et al (2019) in their study on building collapse in Nigeria (2009 – 2019) revealed that South West geopolitical zone (Lagos, Ibadan) experienced the highest number of collapses and the highest loss of lives during the period reviewed, followed by the North Central (Abuja), South East (Owerri), South – South (Port Harcourt), North East and lastly North West.

3.2.1 Description of the Study Areas

A brief description of the cities (Abuja, Ibadan, Lagos, Owerri and Port Harcourt) used as the study areas is as follows:

Abuja City

Abuja began its existence on 3rd February 1976 when the federal military government accepted the recommendation that Lagos – the Nigerian capital could no longer perform the dual role of state and federal capital. It is located in the central part of Nigeria, north of the confluence of the Niger and Benue Rivers The city is part of the Federal Capital Territory (FCT) whose land area of about 8,000 Km^2 makes it almost two and half times the size of Lagos State, the former capital territory of Nigeria, the most populous country in Africa and the sixth most populated in the world.

The geography of the area is defined by two renowned rock formations – the Zuma Rock from whose base the FCT begins and the Aso Rock that is located to the east of the city. Abuja lies at latitude 9.07^0N and longitude 7.48^0E, and at an elevation of 840m (2,800 ft) above the sea level. This elevation and tropical location gives Abuja a mild weather which contrasts sharply with the humid weather of Lagos, which is located on the shores of the Atlantic Ocean at 35m (116.67ft) above sea level. The Abuja area has two distinct seasons: the rainy season that lasts from April to October with rainfall ranging from 305 – 762mm (12 – 30 inches) and temperatures rising up to 40^0C in May, and the dry season that lasts from November through March with dry winds lowering the temperature to as low as 12^0C. Because of its abundant rainfall, rich soil and the location within the Guinea-Savanna vegetation zone, the region is agriculturally productive, with maize and tubers as the dominant crops.

Abuja's situation at the geographical center of Nigeria and its strategic position at the intersection of two highways linking the northern and southern parts of the country make it more accessible than Lagos. For example, while the road distance from Maiduguri in Borno State in northeastern part of Nigeria to Lagos is about 1,609 Km (1,000 miles), in contrast , the distance from Abuja to all parts of the country is less than 965 Km (600 miles). This centrality and accessibility is actually one of the reasons why the new capital city was created.

In terms of administration, there are six local area councils created within the FCT - Abuja Municipal Council, Abaji, Bwari, Kuje, Gwagwalada and Kwali. The development in Abuja is done in phases: Phase I- consists of residential districts of Maitama, Wuse, Garki, Asokoro and Guzape for Abuja's who is who.

Phase II - Consists of fifteen residential districts and only five districts of Kado, Jabi, Utako, Wuye and Gudu/Apo are nearly fully developed. The rest are at different stages of development because of the sluggish pace of infrastructural development.

Phase III- Has nineteen residential districts, only two districts (Gwarimpa I and Life Camp) have been fully developed, and Nbora and Lokogoma are currently underway

(https://www.researchgate.net/publication/263316692) - Abuja city profile [accessed Oct 13 2018]

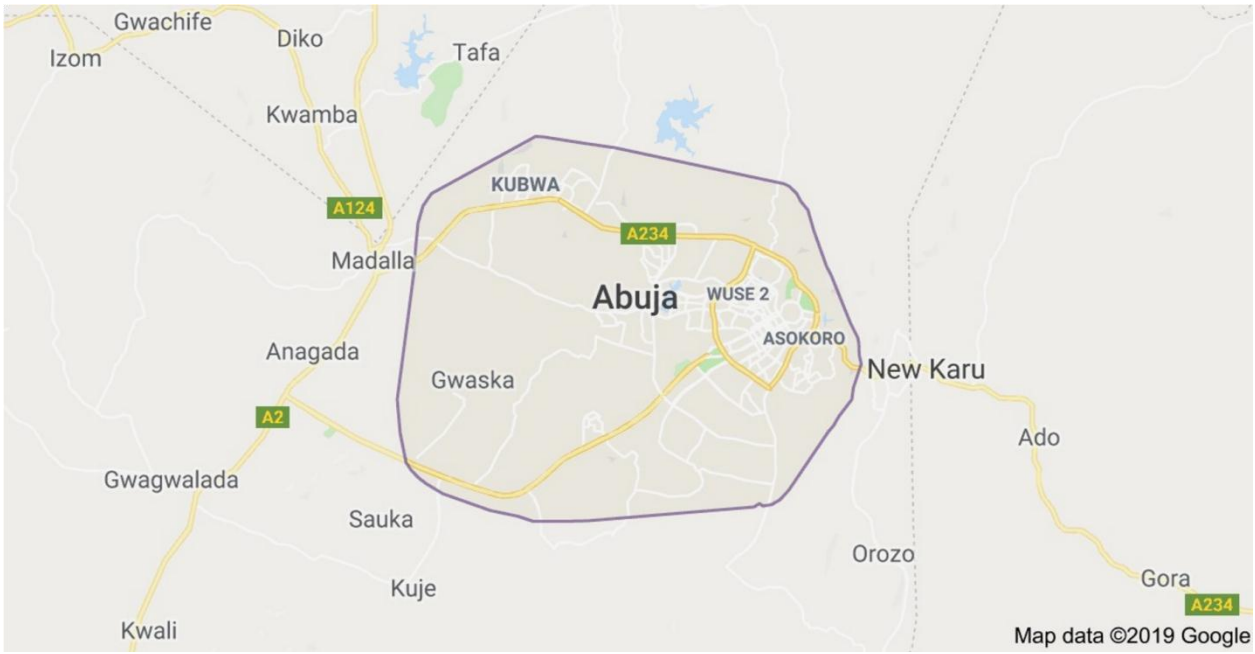


Figure 3.1: Map of Abuja City

Source: www.google.ng

Lagos City

Lagos is the economic hub of Nigeria and largest city in Africa with a population of approximately 11 million (US Census Bureau 2006, Un, World Bank and US Census Bureau estimates 1999). It is currently the 7th largest city in the world, and with current annual growth rates of about 6% - 8% (ie up to 600,000 persons per annum or 1,644 people daily). It was projected to become the 3rd largest city in the world by 2015.(US Census Bureau,2006). It was the formal capital city of Nigeria before it was replaced by Abuja on 12th December, 1991 but remains as the commercial and industrial nerve center of the country.

Lagos was originally founded as a trading port in 17th century by the Portuguese and became colonial administrative headquarters of the newly formed Nigeria in 1914 and remained as capital even after independence in 1960 and until 1991 when a new federal capital territory was built in Abuja. It is the smallest of the administrative states in the country in terms of land area occupying only 3,577 Sq Km of mostly coastal plains.

The state is surrounded by lagoons which make up about 22% of the state's land mass. Metropolitan Lagos itself accounts for only 37% of the state's land area , but is occupied by more than 8% of the state's population, such that population densities in the state reaches up to 20,000 persons per Sq Km (Lagos State Government, 2004).

The state has 16 local government council and 57 Local Government Development Areas. The state has witnessed rapid growth in demand for all types of properties, especially during the era of economic boom of the late 1970s up to 1980s according to Oni (2010). Developers and owners attempt at meeting the shortage in supply of properties either through construction of new structures or through redevelopment of existing structures in attempt to meeting skyrocketed and soaring demand for properties, many properties especially residential properties which were originally approved for one storey buildings were converted to two or more storey buildings (Adediji, 2006). The unprecedented rush by developers to increase the stock of housing units partly accounted for great activities in the construction industry during these periods whereby many of the construction activities lacked proper monitoring (Oni, 2010)

Figure 3.2: Map of Lagos City
Source: www.google.ng

The City of Ibadan

Ibadan is the capital of Oyo State and is the third largest city in Nigeria by population (after Lagos and Kano), and the largest in geographical area (Azeez et al, 2015). At independence, Ibadan was the largest and the most populous city in Nigeria and the third in Africa after Cairo and Johannesburg.

The city of Ibadan is located approximately on the longitude $3^0$55'00'' East of the Greenwich Meridian and latitude $7^0$23'47'' North of Equator at a distance some 145 kilometers Northeast of Lagos. Ibadan is located in Southwestern Nigeria about 120 Km east of the border with the Republic of Benin in the forest zone close to the boundary between the forest and the savanna.

There are eleven local governments in Ibadan metropolitan area consisting of five urban local governments in the city and six semi-urban local governments in the less city.The five urban local governments are: Ibadan Northeast, Ibadan North Central, Ibadan Northwest, Ibadan Southwest and Ibadan Southwest. Urban cores (high density) and hinterlands (low-density) characterized Ibadan metropolis.

The population of Ibadan metropolis is 2,550,593 according to 2006 census. However, its population at 2016 is estimated to be 3.16 million (CIA World Fact, 2016).

Figure 3.3: Map of Ibadan City

Source: www.google.com.ng

The Port Harcourt City

Port Harcourt is the capital of Rivers State and is known as the Nigerian Garden City. The city lies 40 Km up the mouth of the Bonny River in the Niger Delta and is located within the humid tropics of the Southern part of Nigeria on a relatively firm land about 66 Km from the Atlantic Ocean (Ukpere, 2005). The geographical coordinates of the city limit lies approximately within latitude 4^0 40' and 5^0 01^1 North and longitude 6^0 50' and 7^0 01^1 East (Bekwe, 2002). It was originally known as "Igwu Ocha" by the indigenous Ikwerre people and was founded in 1913 by the British in an area traditionally inhabited by Ikwerre and the Okrika Ijaw. It was renamed after Viscount Lewis Harcourt, then British Secretary of State for the Colonies. The initial purpose of the port was to export the coal, which geologist Albert Ernest Kitson had discovered in Enugu in 1912 (Ogionwo, 1979).

The modern Port Harcourt metropolis is now made up of Port Harcourt City and Obio/Akpor Local Government Areas covering a total area of 360 Km^2 and 260 Km^2 respectively.

Port Harcourt is one of Nigeria's fastest growing cities. The average annual growth rate of Port Harcourt between 1963 and 2010 has been computed to be 5.2%. The growth of Port Harcourt is tied to the social and economic history of the country.

The city is a major educational, administrative and industrial center, and is regarded as the oil capital of Nigeria, since it hosts most of the nation's multi-national oil and gas exploration and production companies, two refineries, petroleum-related service companies, as well as a fast expanding commercial sub-sector (Wokekoro and Owei, 2006).

Figure 3.4: Map of Port Harcourt City

Source: www.google.ng

The City of Owerri

Owerri is the capital of Imo State, Nigeria. It falls between latitudes $5^0\,23^1$ and $5^0\,25^1$ N and longitudes $7^0\,2^1$ and $14^0\,33^1$ E .Owerri consists of three Local Government Areas including Owerri Municipal, Owerri North and Owerri West.

Owerri is found in the tropical rainforest region of Nigeria. The city is drained by River Nwaorie and River Otamiri and their tributary streams. Like most cities in Nigeria, it experiences two distinct climatic seasons, namely dry (October to March) and wet (April to September) seasons. The city has projected population of 610,211 people (NPC, 2007) and unevenly distributed over a total area of 57.97 Km^2. The assemblage of infrastructure makes Owerri the hub of economic and industrial activities generating different types of solid wastes.. With the upsurge in the number of institutions, volume of activities, and in fact, the increasing trend in migration from surrounding rural communities towards Owerri.

The Owerri Slogan is Heartland. It is currently referred to as the entertainment capital of Nigeria because of its high density of spacious hotels, high street casinos, production studios and high quality centers of relaxation. It is the home to annual beauty pageants, 'Miss Heartland" and " Miss Adanma".

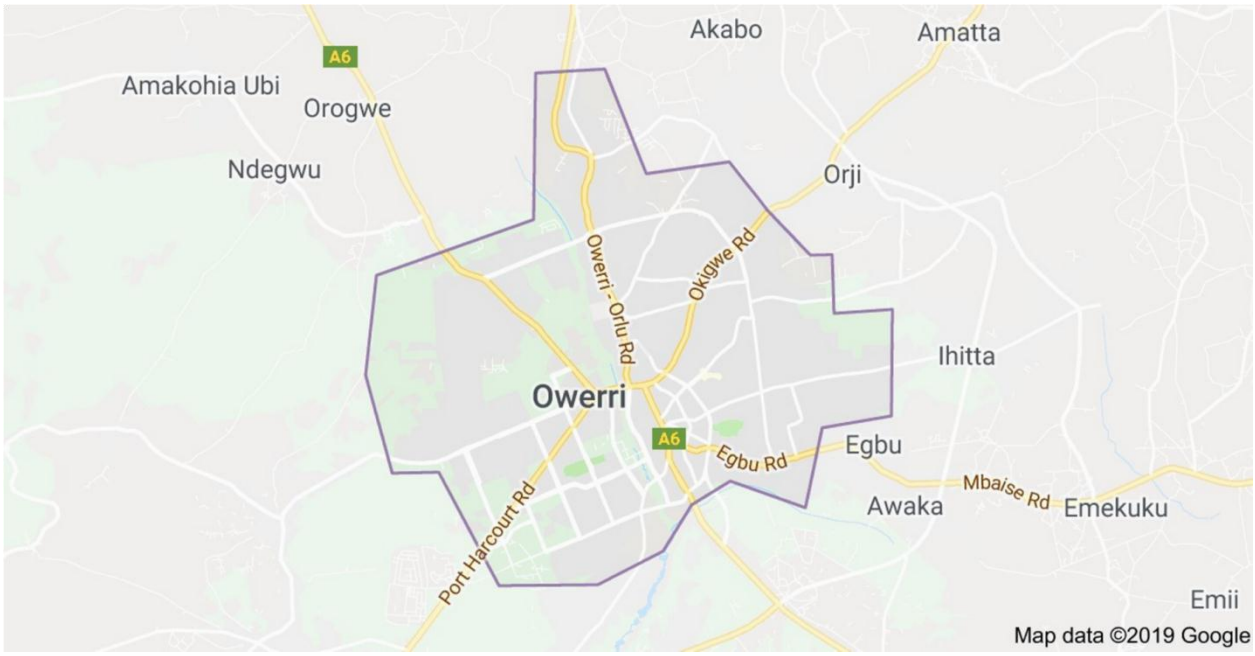


Figure 3.5: Map of Owerri City

Source: www.google.ng

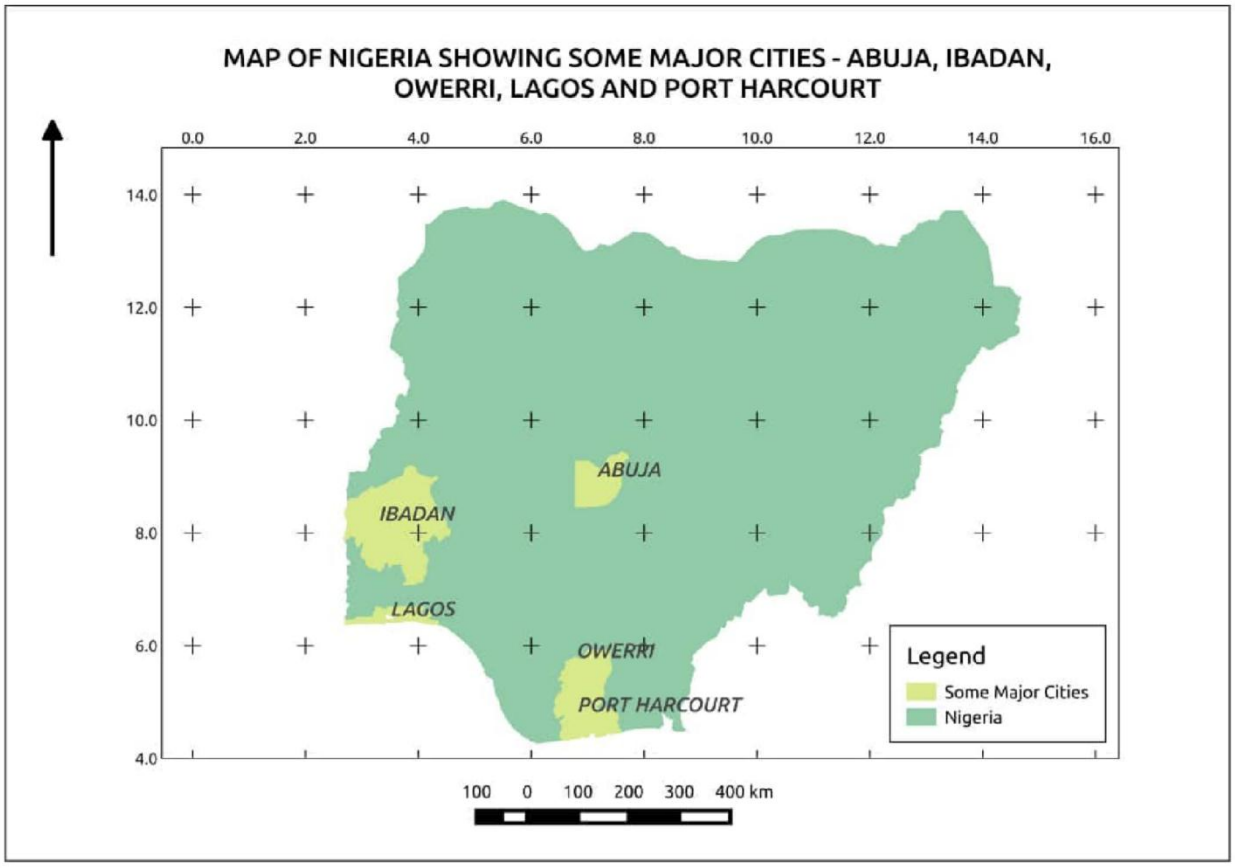


Figure 3.6: Map of Nigeria showing some major Cities – Abuja, Ibadan, Owerri, Lagos and Port Harcourt

Source: Ministry of Lands and Urban Development, Enugu.

3.3 Population of study

The population of the study is made up of the key professionals in the building industry(5,629), Neighbourhood of the collapsed buildings (9,600) and Staff of Emergency Management Agencies in Abuja, Owerri, Ibadan, Lagos and Port Harcourt(9,000) These groups of professionals include registered Builders, Architects, Engineers (Civil, Mechanical and Electrical), Town Planners and Quantity Surveyors. The total population of the study is 24,829 (Field Survey, 2019). The key professionals comprise of 1,065-Architects, 433-Builders, 3,412Engineers (Civil, Mechanical, and Electrical), 403-Town Planners and 316-Quantity Surveyors. The population is presented in Table 5

Table 3.1: Total Population of the Professionals

Registered Professionals	Abuja	Ibadan	Owerri	Lagos	Port Harcourt	Total
Architects	280	220	155	230	180	1,065
Builders	90	100	43	160	40	433
Engineers(Civil, Mechanical & Electrical)	650	732	650	850	530	3,412
Quantity Surveyors	75	60	45	85	51	316
Town Planners	60	100	75	98	70	403
Total	1,163	1,217	955	1,428	866	5,629

Source: State Chapters' Offices of the Professional Bodies (2019).

The total population for neighbourhood of the collapsed buildings is 9,600 (Field study, 2019), while the staff of Emergency Management Agencies is 9,000 (State Offices of the Emergency Management Agencies, 2019).

3.4 Sample Size and Sampling Techniques

To determine the sample size of the professionals in the selected cities used for the study, the statistical formular for determining sample size for finite population as adopted by Taro Yamane (1974) was used. The formular is stated as:

$$n = \frac{N}{1 + N (e)^2}$$

Where n = sample size

N = Total Population

e = limit of tolerance error.

1 = Unity

Using e = 5% = 0.05

Sample size for Architects

The total population of Architects in the five cities N = 1065

Substituting n = $\frac{1,065}{1 + 1065(0.05)^2}$ =, approximately = 290.

The 290 architects were shared equally by the five cities with each city having 58 samples.

Sample size for Builders

The total population of Builders in the five cities N = 433

Substituting n = $\frac{433}{1 + 433\ (0.05)^2} = 207$

A total sample of 207 builders was shared equally by the five cities with city having 41 samples

Sample size for Engineers

The total population of Engineers in the five cities N = 3,412

Substituting n = $\frac{3,412}{1 + 3,412(0.05)^2} = 358$

A total sample of 358 Engineers was shared equally by the five cities with city having 71 samples

Sample size for Quantity Surveyors

The total population for the Quantity Surveyors in the five cities N = 316

Substituting n = $\frac{316}{1 + 316\ (0.05^2)} = 176$

A total sample of 176 Quantity Surveyors was shared equally by the five cities with each city having 35 samples

Sample size for Town Planners

The total population for Town Planners in the five cities N = 403

Substituting $n = \frac{403}{1 + 403\ (0.05^2)} = 200$

A total sample of 200 Town Planners was shared equally by the five cities with each city having 40 samples.

Table 3.2: Distribution of Sample Size for the Professionals

Professionals	Abuja	Ibadan	Owerri	Lagos	P/Harcourt	Total
Architects	58	58	58	58	58	290
Builders	41	41	41	41	41	207
Engineers (Civil, Mech. & Electrical)	71	71	71	71	71	358
Quantity Surveyors	35	35	35	35	35	176
Town Planners	40	40	40	40	40	200
Total						1,231

Sample Size for Neighbourhood of the Collapsed Buildings in the study area

To determine the sample size of the neighbourhood of the collapsed buildings in the selected cities used for the study, the statistical formular for determining sample size for finite population as adopted by Taro Yamane (1974) was used. The formular is stated as:

$$n = \frac{N}{1 + N (e)^2}$$

Where n = sample size

N = Total Population

e = limit of tolerance error.

1 = Unity

Using e = 5% = 0.

The total population of the staff of emergency management agencies in the five cities N = 9,600

Substituting $n = \frac{9,600}{1 + 9600 (0.05)^2} = 384$

The sample size of the staff of emergency management agencies = 384.

The Total Sample Size for the study is shown in Table 3.3 below

Sample Size for the Staff of Emergency Management Agencies

To determine the sample size of the staff of emergency management agencies in the selected cities used for the study, the statistical formular for determining sample size for finite population as adopted by Taro Yamane (1974) was used. The formular is stated as:

$$n = \frac{N}{1 + N (e)^2}$$

Where n = sample

size N = Total

Population

e = limit of tolerance error.

1 = Unity

Using e = 5% = 0.

The total population of the staff of emergency management agencies in the five cities N = 9,000

Substituting $n = \frac{9,000}{1 + 9000\ (0.05)^2} = 382$

The sample size of the staff of emergency management agencies = 382

The Total Sample Size for the study is shown in Table 3.3 below

Table 3.3: Distribution of the Sample Size for the Study

S/No	Description	Sample Size
1	Professionals	1, 231
2	Neighbourhood of the Collapsed Buildings	384
3	Staff of Emergency Management Agencies	382
4	Total	1, 997

3.4 Sources of Data Collection

Two major sources of data collection were used for the study. They include;

3.5.1 Primary Source of Data Collection

The primary source of data collection was through questionnaire administration.

3.5.2 Secondary Source of Data Collection

These include data collected from published materials like, text books, magazines, journals, internet etc.

3.5.3 Administration of the Questionnaire

The researcher administered the questionnaire by distributing them to the respondents that were included in the sample through the help of research assistants.

3.5.4 Construction and Collection of the Questionnaire

The questionnaire was structured to have closed and open ended questions. A 3 – 5 likert scale was used to prepare the close ended questions. Instructions on how to complete the questionnaire were made known to the respondents and completed questionnaires were collected back on the spot but where the research assistants were asked to come back at a later date, they went back.

3.6 Validity and Reliability of Instrument

3.6.1 Validity of Instrument

Validity is simply defined as the appropriateness of an instrument in measuring what is intended to measure (Uzoagulu, 2011).The instruments for primary data collection, questionnaires and oral interviews were validated using content validity. The content validity was chosen because it shows the extent to which the items of an instrument are representative of the content and behavior specified by the theoretical concept being measured (Nkpa, 1997). Therefore, the questionnaire and oral interview questions were sent to my supervisors, some practicing builders and project managers for face and content validity.

3.6.2 Reliability of Instrument

Reliability of a test is the consistency of the instrument in measuring whatever it purports to measure (Uzoagulu, 2011). It can also be described in terms of stability and dependability. An instrument is said to be reliable when a test instrument is dependable and stable in measurement.

A pilot survey using 40 respondents was conducted while a test-retest method was adopted in measuring the internal consistency of the instrument. The Cronbach's Alpha formula was used to obtain the reliability coefficient. The formula is shown below.

$$a = \frac{K\,(Cov/var)}{1 + (k-1)\,(cov/var)}$$

Where K = Number of items on the survey

Cov = Average inter-item covariance

Var = Average item variance

I = A constant

a = Cronbach's Alpha coefficient

To establish the reliability of the questionnaire, forty copies of the questionnaire were administered to twenty (20) Key Professionals in building industry, ten (10) staff of Emergency Management Agencies and ten (10) Project Managers in the study areas. The key professionals in the building industry, the reliability coefficient was 0.70. The reliability coefficient for staff of Emergency Management Agencies was 0.80 and that of Project Managers was 0.90. The overall reliability coefficient of the entire instrument was 0.80, indicating a high level of internal consistency. See Appendix K.

3.7 Method of Data Presentation and Analysis;

Data collected for the study were presented in tables, bar charts and pie charts. The results were analyzed using descriptive statistical techniques which include frequencies, percentages, mean and Relative Importance Index (RII). Test of Hypotheses was done using One Way Analysis of Variance (ANOVA), Principal Component Analysis (PCA) and Statistical Package for Social Science (SPSS, Version 23). Principle Component Analysis

was also used to strengthen the results of objective 2. ANOVA was used to test hypotheses 1, 3 & 4 while PCA was used for hypothesis 2. Content Analysis was performed on the identified building collapse risks to reduce them to considerable number and eliminate collinearity for the purpose of grouping the building collapse risks into different categories Cluster Analysis was performed to ascertain the similarity and dissimilarity of the identified building collapse risks. Confirmatory Factor Analysis was employed to confirm the identified building collapse risks using Maximum Likelihood extraction and Varimax with Kaiser Normalisation rotation. The above tools were considered suitable for this work because they satisfied the assumptions of ANOVA which includes test of homogeneity of variance and test of normality.

The response options in the instrument were weighted as shown below;

Very effective - 5
Effective - 4
Undecided - 3
Ineffective - 2
Very Ineffective - 1
Strongly agree - 5
Agree - 4
Undecided - 3
Disagree - 2
Strongly disagree - 1

The cut – off point for the mean is determined by adding the weights and dividing by the number of weights. That is $\frac{5 + 4 + 3 + 2 + 1}{5} = \frac{15}{5} = 3$

Analysis based on the Objectives

The analysis of the objectives of the study was as follows:

Objectives One was analyzed and ranked using Mean while Objective Two was analyzed using Mean and Principal Component Analysis (PCA)

Mean Score: This method is used for ranking purposes to determine the most effective processes for the management of building collapse risks, and the building collapse risks that impact mostly on the building development and Nigerian economy. It is expressed as:

$$MS = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + n}{N}$$

Where: 5…..1 are the weightings on the Likert Scale

N= Total number of responses

Objective three was analyzed and ranked using Relative Importance Index (RII) while in Objective Four Mean and Principal Component Analysis (PCA) were used.

Relative Importance Index (RII). This was used to determine the relative importance to the respondents of the challenges faced by the management agencies in the management of building collapse risk in Nigeria and critical success factors for effective management of building collapse risks in Nigeria. The relative importance index was calculated using the Likert's Scale

$$\text{Relative Importance Index} = \frac{\Sigma = 5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{AN \qquad 5N}$$

Where w is the weighting given to each factors by the respondents, ranging from1 to 5. While n_1 = number of respondents for strongly disagree n_2 = number of

respondents for disagree n_3 = number of respondents for undecided n_4 = number of respondents for agree n_5 = number of respondents for strongly agree.

A is the highest weight (i.e. 5 in the study) and N is the total number of respondents (1860, for the study). The relative importance Index (RII) ranges from o to 1 (Tam and Le, 2006)

Objective Five was achieved using the most critical success factors for effective management of building collapse risks derived from Objective four to develop and validate a framework for effective management of building collapse risks in Nigeria.

3.8 Content Analysis

Content analysis according to Leedy and Ormrod (2001) is a detailed and systematic examination of the contents of a particular body of materials for the purpose of identifying pattern, themes or biases. Seaman (1999) defined content analysis as the analysis method based on counting the frequency of occurrence of some meaningful lexical phenomenon in a textual data. Journal articles and publications were used to generate appropriate categories for responses. Different building collapse risk factors identified from building collapse that contributed to the same meaning were grouped into one category. This process was repeated until distinct set of categories were obtained. Each category represents building collapse risk factors affecting the stakeholders in the built environment, building development and the Nigerian economy. This is shown in table 2.4. These variables are Economic/Financial Risks, Socio-Political Risks, Human Related Risks, Environmental Risks, Physical Risks and Law/Legal Risks. Content analysis was used because different items were used by different

authors to identify the same building collapse risk factors and it is difficult to know which category a given factor belongs.

3.9 Model Development

A model is a simplified framework that is created to illustrate complex processes. It is a graphical, mathematical (symbolic), physical, or verbal representation or simplified version of a concept, phenomenon, relationship, structure, system, or an aspect of the real world (Muller, 2016). The objectives of a model include (a) to show the interrelationships (direct or indirect) and interrelationship of an action and reaction in terms of a cause and effect, (b) to facilitate understanding by eliminating unnecessary components, (c) to aid in decision making by simulating 'what if' scenarios, (d) to explain, control, and predict events on the basis of past observations.

Models are divided into three classes on the basis of their degree of abstraction (a) Iconic model: It is the least abstract, physical, 'look-alike' representation of some specific entity, such as a model airplane or train or house. (b) Analogue model: more abstract but having some resemblance to what it represents, such as a chart, graph, map, network diagram.(c) Symbolic model: most-abstract model with no resemblance but only an approximation to what it represents, such as a mathematical equation or formula, financial statement, language, and set of accounts (Stanley, 2017). In the context of this research, the total quality model developed falls into the class of an analogous model.

Basis for the Development of Building Collapse Risks Management Model for the Management of Building Collapse Risks in Nigeria:

In this twenty-first century competitive world, the stakeholders in the built environment face the challenges of building collapse and the management of risks associated with such collapses.

Hence, there is the need to provide means of tackling the risks that usually accompany building collapse in Nigeria. The first step towards this feat is to adopt a simple systematic framework to guide all stakeholders in the Nigerian built environment..

A framework was developed that will guide the stakeholders in the built environment on the methods of achieving effective management of building collapse risks prevalent in our environment. The developed framework is based on the Literature Review and the analysis on measures for effective management of building collapse risks. All levels of management must be on board for the program to be truly successful. Any lack of effort or resources will undermine the success of building collapse risks management program, causing negative ripples throughout the organization.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Results

The results of the analysis carried in the study are presented in this section. They are shown in different sub-sections with statistical tools used in the analysis. The statistical tools include:

tables, bar charts, pie charts, percentages, mean score, relative importance index (RII), Analysis of variance (ANOVA), Principal Component Analysis (PCA), etc.

4.1.1 Distribution and Return of Questionnaire

This sub-section presents information on the distribution and retrieval of administered questionnaire as well as socio-economic characteristics of respondents. Table 4.1 shows the response rate of the administered questionnaires.

Table 4.1: Distribution and Return of Questionnaire

Category of Respondents	**Number Distributed**	**Number properly and filled Collected**	**Unreturned**
Professionals	1231	1146(93%)	85(7%)
Neighbourhood of the collapsed buildings	384	360(94%)	24(6%)
Staff of Emergency Management Agencies	382	354(93%)	28(7%)
Total	1997	1860(93%)	137(7%)

Source: Field Survey, 2019

From the analysis in Table 4.1 above, it shows that out of a total of One thousand, nine hundred

and ninety seven (1997) questionnaires distributed to professionals (1231), neighbourhood of the collapsed buildings (384) and staff of emergency management agencies (382), the number correctly filled and returned shows as follows. A total number of One thousand, one hundred and forty six (1146) representing 93 percent of the distributed questionnaires were returned from the professionals. From the neighbourhood of the collapsed buildings, a total of Three hundred and sixty (360) representing 94 percent were returned, while a total of Three hundred and fifty four (354) representing 93 percent were returned from staff of emergency management agencies. The analysis shows that a total of One thousand eight hundred and sixty (1860) were correctly filled and returned representing 93 percent of the entire distributed questionnaires. The above response rate is adjudged high enough to be used for data analysis.

4.1.2 Socio-Economic Characteristics of Respondents

This sub-section shows and analyzes data on socio-economic characteristics of respondents such as age, educational background, profession and working experience. Table 4.2 shows the age of the respondents.

Table 4.2: Age of Respondents

Age (years)	Number of Response
Less than 30	42 (2%)
31 – 40	192(10%)
41 – 50	410(22%)
51 – 60	821(44%)
61 and above	395(21%)
Total	1860(100%)

Source: Field Survey, 2019

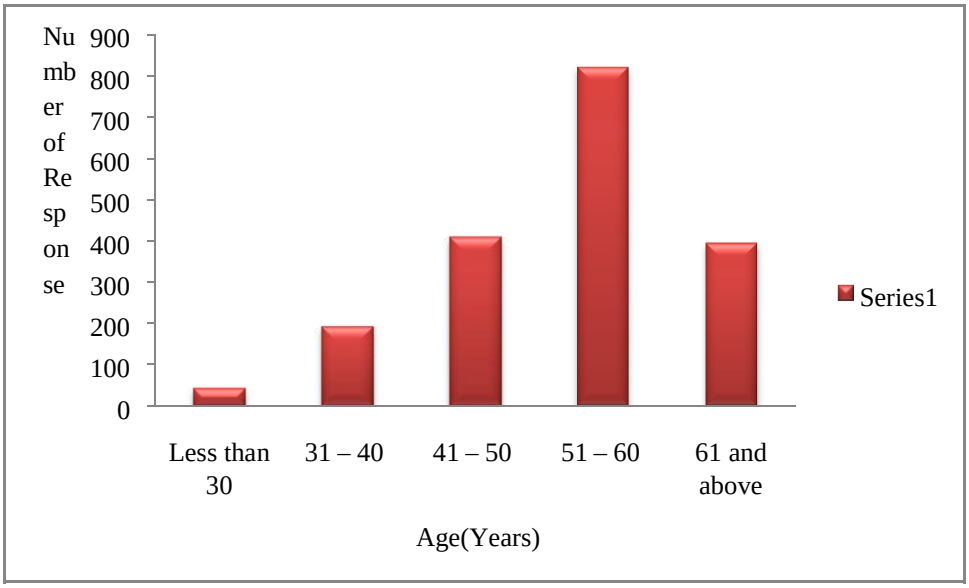


Fig 4.1: Response on Age

Table 4.2 shows that the respondents less than 30 years of age are 42, representing 2 percent of the respondents. The respondents between 31– 40 were 192, representing 10 percent, those between 4 – 50 were 410, representing 22 percent, those between 5 – 60 were 821, representing 44 percent, while those 61 and above were 395, representing 21 percent of the respondents. The analysis shows that majority of the respondents are between ages 31 and above. This also shows that the majority of the respondents are aged enough to understand the problem of the study and therefore experienced to give adequate answers to the questions in the questionnaire. Table 4.3 below shows the educational background of the respondents

Table 4.3: Educational Qualification of Respondents

Response Option	Number of Response
First School Leaving Certificate	Nil
SSCE/GCE	28(1%)
ND/NCE	197(11%)
B.Sc/HND	1219(66%)
M.Sc	361(19%)
PhD	55(3%)
Total	1860(100%)

Source: Field Survey, 2019

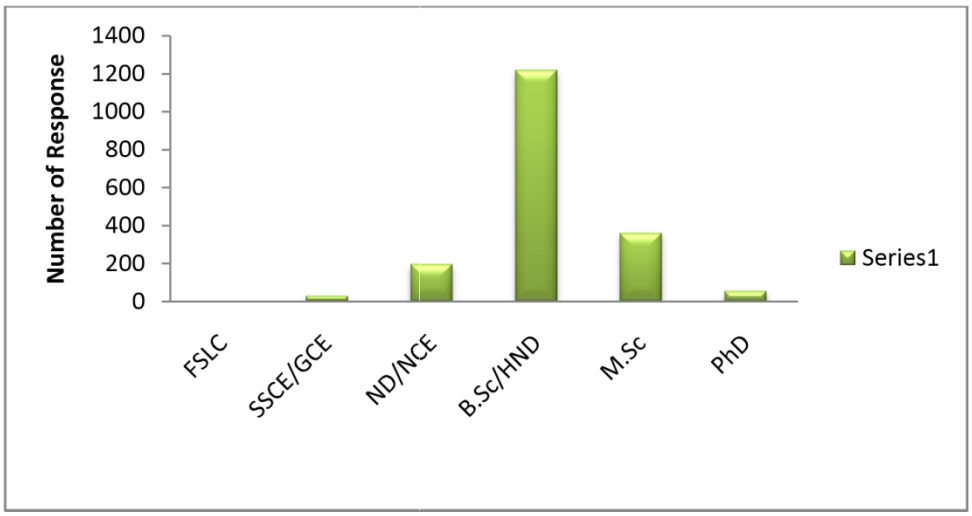


Fig 4.2: Response on Educational Qualifications

The analysis in Table 4.3 above shows that Twenty eight (28), representing 1 percent respondents are SSCE/GCE holders, One hundred and ninety seven (197), representing 11 percent are ND/NCE holders, One thousand, two hundred and nineteen, representing 66 percent are HND/B.Sc holders, Three hundred and sixty one (361), representing 19 percent are M.Sc holders, while fifty five (55), representing 3 percent are PhD holders. Therefore, it could be deduced from the analysis above that majority of the respondents (about 99%) have ND/NCE and above. It could be further stated that the respondents are literate enough to

understand and express ideas on the management of building collapse risks and related issues in the study area.

Figure 4 shows the response on the Profession of the respondents (Professionals only).

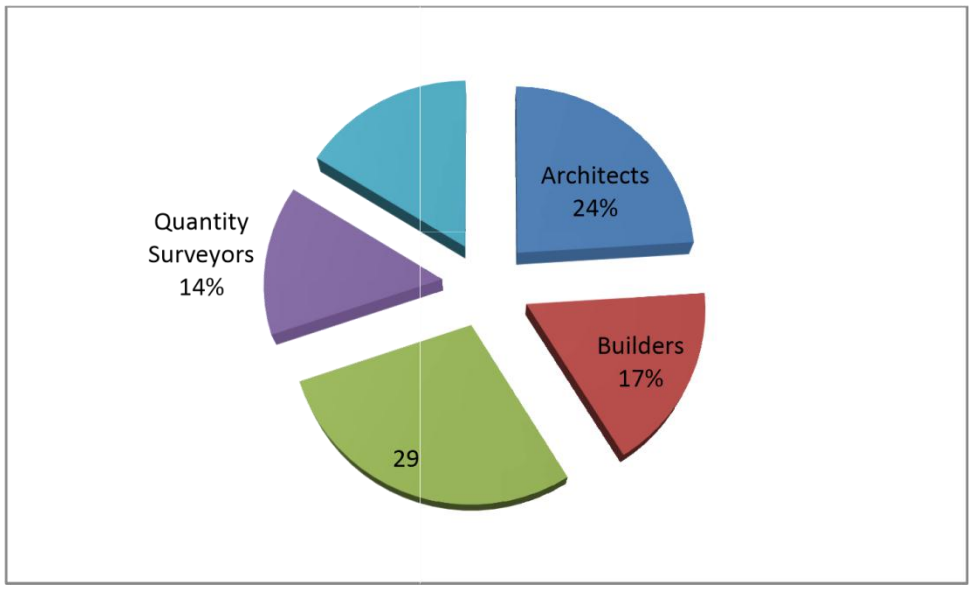
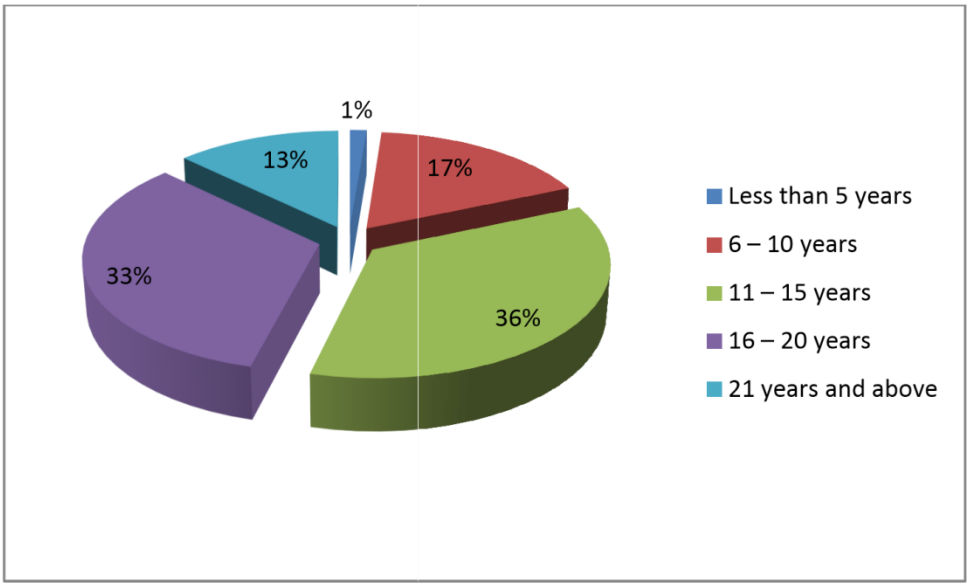


Figure 4.3 shows that the Architects are 275, representing 24 percent, Builders 197, representing 17 percent, Engineers 328, representing 29 percent, Quantity Surveyors 161, representing 14 percent, while the Town Planners are 185, representing 16 percent of the respondents (Professionals only). The result of the analysis further shows that the key professionals in the built environment were adequately represented in the study. Figure 5 shows the working experience of the Professionals.



The analysis in Table 4.4 shows that the professionals less than 5 years working experience are 15, representing 1 percent, those that have working experience between 6 – 10 years were 198, representing 17 percent, those with working experience between 11 – 15 years were 405, representing 35 percent, those with working experience between 16 – 20 years were 381, representing 33 percent, while those with working experience between 21 years and above were 147, representing 13 percent. The analysis shows that majority of the respondents have relevant working experience of 6 years and above. This also shows that the majority of the respondents are well experienced to understand the risks associated with building collapse and could give reliable answers to the questions in the questionnaire

4.1.3 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis was employed to confirm the identified building collapse risks using Maximum Likelihood extraction and Varimax with Kaiser Normalisation rotation. The results were presented in Tables 4.4 – 4.9

Table 4.4: CFA result for economic/financial risks

Economic/Financial Risks		
Variable	Communalities	Factor loading
Loss of property	.681	.567
Loss of annual income/capital investment	.529	.584
Loss of materials	.548	.626
Bankruptcy of investor or developer	.666	.609
Decrease in the contributions of real estate sector to the nation's GDP	.524	.779
Loss of life investment	.548	.735
Increase in the cost of maintenance	.570	.506
Shortage in the supply of real estate facilities	.631	.672
Clean up costs	.500	.695
Rescue costs	.397	.670
Cost of investigation/compensation	.554	.574
Treatment of injured people	.695	.578
Cost of rebuilding/repair	.519	.657
Cost of loss of functionality	.550	.651
Cost of replacement/repair of its contents	.629	.651
Cost of temporary relocation	.539	.653
Regional economic effects	.656	.590
Waste of resources, time and labour	.533	.553
Cost of legal dispute	.653	.771
Total Eigenvalues of variance		10.294
% of Variance		57.185

In the economic/financial risks, all the nineteen variables remained with their factor loading values greater than 0.5, which was considered as acceptable. The CFA result showed that these variable explained about 57.185% of the total variance in economic/financial factors impacting building collapse risks management with total Eigenvalues of variance of 10.294.

The result of KMO test (with KMO (0.776) >0.50) indicated that the sample is adequate, while the Bartlett's Test of Sphericity with Bartlett's Chi-Sq. of 8381.559 and associated p=0.000<0.05 shows that the variables are inter-related (i.e., not orthogonal). However, the correlation matrix is not an identity matrix and the variables are therefore, suitable for further factor analysis.

Table 4.5: CFA result for socio-political risks

Socio-Political Risks		
Variable	Communalities	Factor Loading
Loss of reputations and integrity of the contractors	.644	.695
Psychological trauma and shocks	.664	.632
Loss of new commission and contracts	.533	.721
Withdrawal of practicing licenses	.662	.514
Loss of trust	.561	.511
Discourages investment in property development	.496	.692
Loss of jobs	.999	.999
Scarcity of property	.475	.657
Loss of prestige of the owner	.575	.664
Shortage of manpower	.619	.714
De-marketing the values of industry professionals	.453	.588
Portrays the Nigeria building industry as being corrupt	.555	.670
Professionals' marketability to Foreign firms /clients has been devalued	.587	.543
Total Eigenvalues of variance		8.073
% of Variance		62.099

In the socio-political risks, all the 13 variables remained because their factor loading values were greater than 0.5, which was considered as acceptable. However, the CFA result showed that they explained about 62.099% of the total variance in socio-political factors impacting building collapse risks management, with total Eigenvalues of variance of 8.073. The result of KMO test (with KMO (0.798) >0.50) indicated that the sample is adequate, while the Bartlett's Test of Sphericity with Bartlett's Chi-Sq. of 6787.286 and associated p=0.000<0.05 shows that the variables are inter-related (i.e., not orthogonal). However, the correlation

matrix is not an identity matrix and the variables are therefore, suitable for further factor analysis.

Table 4.6.: CFA result for human related risks

Human Related Risks		
Variable	Communalities	Factor Loading
Loss of lives	.406	.694
Injuries	.535	.793
Disruption of educational activities	.567	.622
Loss of the contribution from the victims towards the socio-economic growth of the nation	.595	.770
Increase in death rate against the United Nations Millennium Development Goals (MDGs)	.435	.674
Leads the victims to permanent disability	.980	.989
Psychological damage (fear, helplessness, distress, depression and suicides)	.453	.509
Disruption of economic activities	.464	.635
Total Eigenvalues of variance		4.246
% of Variance		53.083

Likewise, in the human related risks, all the 8 variables remained because their factor loading values were greater than 0.5, which was considered as acceptable. The CFA result then showed that they explained about 53.083% of the total variance in human related factors impacting building collapse risks management, with total Eigenvalues of variance of 4.246. The result of KMO test (with KMO (0.839) >0.50) indicated that the sample is adequate, while the Bartlett's Test of Sphericity with Bartlett's Chi-Sq. of 3324.106 and associated $p=0.000<0.05$ shows that the variables are inter-related (i.e., not orthogonal). However, the correlation matrix is not an identity matrix and the variables are therefore, suitable for further factor analysis.

Table 4.7: CFA result for environmental risks

Environmental Risks		
Variable	Communalities	Factor Loading
Provides hideouts for robbers and hoodlums	.402	.616
Place of abode for dangerous animals like snakes	.406	.573
Environmental damage	.547	.535
Loss of functionality in the neighborhoods	.671	.589
CO_2 Emissions/Pollution	.448	.662
Reduction in the energy use	.534	.556
Increase in toxic emission	.407	.649
Environmental studies/repair	.498	.697
Loss of building aesthetic values	.531	.631
Degrading of the environment	.812	.680
Total Eigenvalues of Variance		6.818
% of Variance		68.171

In the environmental risks also, all the 10 variables remained because their factor loading values were greater than 0.5, which was considered as acceptable. The CFA result however, showed that they explained about 68.171% of the total variance in environmental risks factors impacting building collapse risks management, with total Eigenvalues of variance of 6.818. The result of KMO test (with KMO (0.730) >0.50) indicated that the sample is adequate, while the Bartlett's Test of Sphericity with Bartlett's Chi-Sq. of 3874.200 and associated p=0.000<0.05 shows that the variables are inter-related (i.e., not orthogonal). However, the correlation matrix is not an identity matrix and the variables are therefore, suitable for further factor analysis.

Table 4.8: CFA result for physical risks

Physical Risks		
Variable	Communalities	Factor Loading
Structural damage	.715	.760
Damage to contents	.480	.667
Loss of functionality	.456	.565
Replacement/repair of structure	.402	.645
Replacement/repair of contents	.517	.552
Temporary relocation	.594	.619
Loss of strength of the building	.413	.562
Shortage of manpower	.584	.694
Increment of sick citizens	.401	.598
Street blockage	.453	.620
Evacuation difficulty	.448	.644
Travel distance increment	.541	.521
Damage of materials beyond re-use	.446	.621
Loss of fauna and flora	.521	.521
Total Eigenvalues of variance		7.608
% of Variance		54.342

All the 14 variables of physical risks remained after factor analysis because their factor loading values were greater than 0.5, which was considered as acceptable. However, the CFA result showed that they explained about 54.342% of the total variance in physical factors impacting building collapse risks management, with total Eigenvalues of variance of 7.608. The result of KMO test (with KMO (0.828) >0.50) indicated that the sample is adequate, while the Bartlett's Test of Sphericity with Bartlett's Chi-Sq. of 8271.004 and associated p=0.000<0.05 shows that the variables are inter-related (i.e., not orthogonal). However, the correlation matrix is not an identity matrix and the variables are therefore, suitable for further factor analysis.

Table 4.9: CFA result for law/legal risks

Law/Legal Risk s		
Variable		Factor Loading
Exasperation of crises among stakeholders	.999	.999
Legal tussle among stakeholders	.512	.674
Arbitration/Mediation to resolve crises arising from building collapse	.467	.665
Conflicts resolution	.437	.635
Apportioning blames and arbitrary words of mouth among the stakeholders	.511	.551
Total Eigenvalues of Variance		3.167
% of Variance		63.351

All the 5 variables of law/legal risks remained after factor analysis because their factor loading values were greater than 0.5, which was considered as acceptable. However, the CFA result showed that they explained about 63.351% of the total variance in law/legal factors impacting building collapse risks management, with total Eigenvalues of variance of 3.167. The result of KMO test (with KMO (0.623) >0.50) indicated that the sample is adequate, while the Bartlett's Test of Sphericity with Bartlett's Chi-Sq. of 1312.693 and associated p=0.000<0.05 shows that the variables are inter-related (i.e., not orthogonal). However, the correlation matrix is not an identity matrix and the variables are therefore, suitable for further factor analysis

4.1.4 IMPACT OF BUILDING COLLAPSE RISKS ON THE BUILDING DEVELOPMENT IN NIGERIA.

Table 4.10: Impact of Economic/Financial risks on building development in Nigeria.

S/No	Economic/Financial Risks	Very Severe(5)	Severe (4)	Moderate (3)	Minor (2)	No injury (1)	Mean	Rank
1	Loss of property	1178(63%)	589(32%)	62(3%)	31(2%)	0	6.80	1st
2	Loss of annual income/capital investment	713(38%)	899(48%)	186(10%)	62(3%)	0	5.66	7th
3	Loss of materials	868(47%)	744(40%)	155(8%)	62(3%)	31(2%)	5.78	4th
4	Decrease in the contributions of real estate sector to the nation's GDP	620(33%)	899(48%)	217(312)	124(12%)	0	5.38	11th
5	Bankruptcy of investor or developer	496(27%)	806(43%)	434(23%)	124(6%)	0	5.05	15th
6	Loss of life investment	558(30%)	868(47%)	279(15%)	124(6%)	31	5.14	13th
7	Increase in the cost of maintenance	527(32%)	744(40%)	341(18%)	248(13%)	0	5.10	14th
8	Shortage in the supply of real estate facilities	589(32%)	713(38%)	341(18%)	186(10%)	31	5.23	12th
9	Clean up costs	713(38%)	713(38%)	279(15%)	155(8%)	0	5.63	8th
10	Rescue costs	744(40%)	496(27%)	465(25%)	155(8%)	0	5.79	6th
11	Cost of investigation/	651(35%)	589(32%)	434(23%)	186(10%)	0	5.60	9th
	Compensation							
12	Treatment of injured people	930(50%)	713(38%)	124(6%)	93(5%)	0	5.83	3rd
13	Cost of rebuilding/repair	992(53%)	744(40%)	93(5%)	31(2%)	0	5.97	2nd
14	Cost of loss of functionality	403(22%)	837(45%)	496(27%)	124(6%)	0	4.73	17th

15	Cost of replacement/ Repair of its contents	620(33%)	1085(58%)	155(8%)	0	0	5.55	10th
16	Cost of temporary relocation	403(22%)	899(48%)	465(25%)	93(5%)	0	4.92	16th
17	Regional economic effects	279(15%)	837(45%)	496(27%)	217(312%)	31	4.55	18th
18	Waste of resources, time and labour	868(47%)	713(38%)	155(8%)	93(5%)	31(2%)	5.75	5th

From the analysis in Table 4.10 above, it shows that economic/financial risks severely impact negatively on the building development in Nigeria. The degree of the severity is shown by their mean values: loss of property- 6.80, followed by cost of rebuilding/repair -5.97, treatment of injured people – 5.83, loss of materials -5.78, and Waste of resources, time and labour – 5.75, among others. The analysis concludes that in economic/financial risks, loss of property has the greatest impact on the building development in Nigeria followed by, cost of rebuilding/repair, treatment of injured people, loss of materials, waste of resources, time and labour

Table 4.11: Impact of Socio-Political Risks on the building development in Nigeria

S/No	Socio-Political Risks	Very Severe(5)	Severe (4)	Moderate (3)	Minor (2)	No injury (1)	Mean	Rank
1	Loss of reputations and integrity of the contractors	1023(55%)	651(35%)	155(8%)	31(2%)	0	6.69	2nd
2	Psychological trauma and shocks	682(37%)	899(48%)	248(13%)	31(2%)	0	5.81	6th
3	Loss of new commission and contracts	589(32%)	961(52%)	186(10%)	62(3%)	62(3%)	5.48	8th
4	Withdrawal of practicing licenses	620(33%)	558(32%)	372(20%)	248(13%)	62(3%)	5.61	7th
5	Loss of trust	775(42%)	837(45%)	248(13%)	0	0	6.25	3rd
6	Discourages investment in property development	713(38%)	589(32%)	310(17%)	155(8%)	9362(5%)	5.97	5th
7	Loss of jobs	558(30%)	930(50%)	186(10%)	155(8%)	31(2%)	5.39	9th
8	Scarcity of property	434(23%)	775(42%)	279(15%)	310(17)	62(3%)	4.99	11th
9	Loss of prestige of the owner	310(17%)	868(47%)	372(20%)	155(8%)	155(8%)	4.60	12th
10	Shortage of manpower	279(15%)	496(26%)	589(32%)	465(25%)	31(2%)	4.34	13th
11	De-marketing the values of industry professionals	434(23%)	837(45%)	279(15%)	217(12%)	93(5%)	5.30	10th
12	Portrays the Nigerian building industry as being corrupt	775(42%)	589(32%)	341(18%)	93(5%)	31(5%)	6.16	4th
13	Professionals' marketability to foreign firms/clients has been devalued	1116(60%)	465(25%)	186(10%)	93(5%)	0	6.81	1st

From the analysis above in Table 4.11, it shows that socio-political risks severely impact on the building development in Nigeria. The extent of the negative impact of socio-political risks on the building development in Nigeria is shown by their mean values: professionals'

marketability to foreign firms/clients has been devalued – 6.81, followed by loss of reputations and integrity of the contractors – 6.69, loss of trust – 6.25, portrays the Nigerian building industry as being corrupt – 6.16, discourages investment in the property development -5.97, among others. It could be deduced from the analysis that professionals' marketability to foreign firms/ clients has be devalued tops the list of the socio-political risks that impact negatively on the building development in Nigeria, closely followed by loss of reputation and integrity of the contractors, loss of trust, portrays the Nigerian building industry as being corrupt, discourages investment in the property development, among others.

Table 4.12: Impact of Human related risks on building development in Nigeria

	Human Related Risks	Very Severe(5)	Severe (4)	Moderate (3)	Minor (2)	No injury (1)	Mean	Rank
1	Loss of lives	1240(66%)	403(21%)	62(2%)	155(8%)	0	7.10	1st
2	Injuries	1116(60%)	496(27%)	62(2%)	186(10%)	0	6.91	2nd
3	Disruption of educational activities	217(12%)	310(17%)	837(45%)	372(20%)	124(6%)		8th
4	Loss of the contribution from the victims towards the socio-economic growth of the nation	372(20%)	682(37%)	620(33%)	124(6%)	62(2%)	4.51	6th
5	Increase in death rates against the United Nations Millennium Development Goals (MDGs)	310(17%)	744(40%)	496(27%)	279(15%)	31(2%)	4.44	7th
6	Leads the victims to permanent disability	589(32%)	806(43%)	372(20%)	93(5%)	0	5.31	3rd
7	Psychological damage (fear, helplessness, distress, depression and suicides)	558(30%)	806(43%)	434(23%)	62(2%)	0	5.09	4th
8	Disruption of economic activities	496(27%)	837(45%)	37262(20%)	15562(8%)	0	4.99	5th

From the analysis in Table 4.12, it shows the degree of the negative impact of human related risks on the building development in Nigeria. The human related risks that impact negatively on the building development in Nigeria is mostly as indicated by the following mean values: loss of lives – 7.10, followed by injuries – 6.91, leads victims to permanent disability – 5.31, psychological damage (fear, helplessness, distress, depression and suicides) – 5.09, disruption of economic activities – 4.99, etc. The analysis shows that in human related risks, loss of lives has the greatest impact on the building development in Nigeria. Others are

injuries, leads victims to permanent disability, psychological damage (fear, helplessness, distress, depression and suicides), disruption of economic activities, etc.

Table 4.13: Impact of Environmental Risks on building development in Nigeria

	Environmental Risks	Very Severe(5)	Severe (4)	Moderate (3)	Minor (2)	No injury (1)	Mean	Rank
1	Provides hideouts for robbers and hoodlums	527 (28%)	806(43%)	279 (15%)	248 (13%)	0 (0%)	5.46	4th
2	Place of abode for dangerous animals like snakes	620 (33%)	775(42%)	248 (13%)	217 (12%)	0 (0%)	5.50	3rd
3	Environmental damage	744 (40%)	589(32%)	465 (25%)	62 (3%)	0 (0%)	5.83	1st
4	Loss of functionality in the neighborhoods	372 (20%)	868(47%)	341 (18%)	279 (15%)	0 (0%)	4.70	5th
5	CO_2 Emissions/Pollution	248 (13%)	713(38%)	496(27)	434(23%)	31 (2%)	4.42	8th
6	Reduction in the energy use	217 (12%)	465(25%)	744 (40%)	372 (20%)	62 (3%)	4.21	10th
7	Increase in toxic emission	248 (13%)	620(33%)	434 (23%)	496 (27%)	62 (3%)	4.38	9th
8	Environmental studies/repair	279 (15%)	403(22%)	651 (35%)	434 (23%)	93 (5%)	4.48	7th
9	Loss of building aesthetic values	341(18%)	930(50%)	372(20%)	124(7%)	93 (5%)	4.67	6th
10	Degrading of the environment	651	620	496	62	31 (3%)	5.75	2nd

The analysis in Table 4.13 above shows the impact of environmental risks on the building development in Nigeria. The degree of the impact of environmental risks on the building development in Nigeria is indicated by their mean values: environmental damage – 5.83, followed by degrading of the environment – 5.75, place of abode for dangerous animals like snakes – 5.50, provides hideouts for robbers and hoodlums – 5.46, and Loss of functionality in the neighbourhoods – 4.70. From the analysis, it could be observed that environmental

risks impact on the building development in Nigeria moderately and least impacted by reduction in the energy use.

Table 4.14: Impact of Physical Risks on the building development in Nigeria

	Physical Risks	Very Severe(5)	Severe (4)	Moderate (3)	Minor (2)	No injury (1)	Mean	Rank
1	Structural damage	1209(65%)	496(27%)	124 (7%)	31 (2%)	0 (0%)	6.90	1st
2	Damage to contents	744(40%)	868(47%)	186(10%)	62 (3%)	0	5.98	4th
3	Loss of functionality	589(32%)	930(50%)	248(13%)	93 (5%)	0	5.73	6th
4	Replacement/repair of structure	744(40%)	899(48%)	155(8%)	31(2%)	31(2%)	6.09	3rd
5	Replacement/repair of contents	527(28%)	775(42%)	372(20%)	186(10%)	0	5.68	8th
6	Temporary relocation	465(25%)	868(47%)	434(23%)	93(5%)	0	5.60	9th
7	Loss of strength of the building	899(48%)	620(33%)	248(13%)	93(5%)	0	6.21	2nd
8	Shortage of manpower	341(18%)	434(23%)	558(30%)	434(23%)	93(5%)	5.36	11th
9	Increment of sick citizens	372(20%)	589(32%)	558(30%)	341(18%)	0	5.44	10th
10	Street blockage	279(15%)	806(43%)	496(27%)	248(13%)	31(2%)	4.78	12th
11	Evacuation difficulty	558(30%)	806(43%)	341(18%)	124(7%)	31(2%)	5.80	7th
12	Travel distance increment	186(10%)	558(30%)	651(35%)	434(23%)	31(2%)	4.34	13th
13	Damage of materials beyond re-use	620(33%)	713(38%)	310(17%)	124(7%)	93(5%)	5.81	5th
14	Loss of fauna and flora	124(7%)	651(35%)	558(30%)	465(25%)	62(3%)	4.01	14th

From the analysis in Table 4.8 above, it shows the degree of the impact of Physical risks on the building development in Nigeria. This is shown by their mean values: structural damage – 6.90, followed by loss of strength of the building – 6.21, replacement/repair of structure – 6.09, damage to contents – 5.98, damage of materials beyond re-use, among others. The analysis shows that physical risks severely impact on the building development in Nigeria, with structural damage topping the list and loss of fauna and flora having least effect.

Table **4.15: Impact of Law/Legal risks on building development in Nigeria**

	Law/Legal Risks	Very Severe(5)	Severe (4)	Moderate (3)	Minor (2)	No injury (1)	Mean	Rank
1	Exasperation of crises among stakeholders	403(22%)	868(47%)	496(27%)	93(5%)	0	4.70	4th
2	Legal tussle among stakeholders	527(28%)	868(47%)	403(22%)	62(3%)	0	5.20	2nd
3	Arbitration/Mediation to resolve crises arising from building collapse	434(23%)	868(47%)	372(20%)	186(10%)	0	4.92	3rd
4	Conflicts resolution	372(20%)	961(52%)	372(20%)	124(7%)	31(2%)	4.31	5th
5	Apportioning blames and arbitrary words of mouth among the stakeholders	589(32%)	868(47%)	248(13%)	124(7%)	31(2%)	5.31	1st

The analysis in Table 4.15 above shows the extent law/legal risks impact on the building development in Nigeria. This is shown as indicated by their mean values: apportioning blames and arbitrary words of mouth among the stakeholders – 5.31, followed by legal tussle among stakeholders – 5.20, arbitration/mediation to resolve crises arising from building collapse – 4.92, exasperation of crises among the stakeholders – 4.70 and conflicts resolution – 4.31. The above analysis indicates that law/legal moderately impact on the building development in Nigeria.

From the overall analysis above, the building collapse risks that mostly impact on the building development are human related risks (7.10), followed by physical risks (6.90), socio-political risks (6.81), economic/financial risks (6.80), environmental risks (5.83) and lastly law/legal risks (5.31).

4.1.5 Processes for the Management of Building Collapse Risks in Nigeria

This section provides and analyzes data that relates to the processes for the management of building collapse risks in the study area. Table 4.11 shows the level of effective application of the processes in the current management of building collapse risks in Nigeria.

Table 4.16: Responses on the Processes for the management of Building Collapse Risks in Nigeria.

S/No	Strategies	VE	E	U	I	VI	Mean	Rank
1	Establishment of institutions and agencies to take care of emergency related issues/events	31(2%)	155(8%)	186(10%)	930(50%)	558(30%)	3.55	9th
2	Evacuation and emergency services	62(3%)	310(17)	279(15%)	775(42%)	434(23%)	2.34	14th
3	Provision of temporary accommodation and feeding	155(8%)	155(8%)	372(20%)	868(47%)	310(17%)	3.61	18th
4	Reconstruction of damaged areas	31(2%)	465(25%)	589(32%	496(26%)	279(15%)	1.30	19th
5	Property insurance	434(23%)	837(45%)	279(15%)	217(12%)	93(5%)	2.22	15th
6	Life insurance	31(2%)	465(25%)	589(32%)	496(26%)	279(15%)	1.11	20th
7	Reduce or avoid losses from building collapse	0	93(5%)	186(10%)	465(25%)	1116(60%)	4.81	1st
8	Prompt assistance to the victims	62(3%)	62(3%)	186(10%)	992(53%)	558(30%)	3.69	7th
9	Rapid and effective recovery of dead persons	62(3%)	62(3%)	248(13%)	868(47%)	620(33%)	3.60	8th
10	Maintenance of law and order	31(5%)	93(5%)	341(18%)	589(32%)	775(42%)	4.16	3th
11	Prevention of trespassing, looting, etc	62(3%)	186(10%)	806(43%)	434(23%)	372(20%)	1.80	17th
12	Recovery of dead bodies and their disposal	0	0	248(13%)	837(45%)	775(42%)	4.25	2rd

13	Medicare for the injured	31(1%)	85(6%)	386(20%)	658(35%)	700(38%)	4.11	4th
14	Supply of food and water	31(1%)	124(7%)	496(27%)	806(43%)	403(22%)	2.10	16th
15	Prompt availability of relevant information to the right people	31(3%)	93(5%)	496(27%)	775(42%)	465(25%)	2.60	12th
16	Establishment of Emergency Management Volunteers to compliment the organized structures	0	62(3%)	372(20%)	586(32%)	840(45%)	0.08 0	27th
17	Establishment of Disaster Response Units (DRUs) in different military formations across the country to provide assistance to civil authority during emergencies.	42(2%)	80(4%)	990(53%)	560(30%)	188(10%)	0.5	22nd
18	Proper funding of disaster management structures across the country	31(1%)	124(7%)	806(43%)	403(22%)	496(27%)	3.30	10th
19	Develop capacity of relevant institutions and stakeholders for effective and efficient disaster management in Nigeria	31(1%)	62(3%)	868(47%)	744(40%)	248(13%)	0.80	21st
20	Ensure psychosocial support to affected persons	31(1%)	496(27%)	806(43%)	403(22%)	124(7%)	0.20	23rd
21	Establishment of community structures (Neighbourhood Associations, Schools, Community Based Organizations (CBOs), Faith Based Organizations (FBOs), Non-Governmental Organizations (NGOs)	31(1%)	62(3%)	248(13%)	400(22%)	1119(60%)	0.09	25th
22	Bring order to a chaotic situation	93(5%)	155(8%)	310(17%)	589(32%)	713(38%)	3.97	6th

23	Establishment of Community Disaster Management Teams	31(1%)	93(5%)	248(13%)	868(47%)	620(33%)	0.10	24th
24	Training of disaster management teams in areas such as: Search and rescue, first aid, trauma management, shelter restoration and livelihood resuscitation, among others.	24(1%)	100(5%)	496(27%)	770(41%)	470(25%)	2.99	11th
25	Establishment of emergency communication and information dissemination centers (call centers) across the country	31(1%)	93(5%)	775(42%)	496(27%)	465(25%)	2.34	13th
26	Recruiting team of Facilitators and Enablers for effective and efficient integration and coordination in disaster management	31(1%)	62(2%)	155(8%)	744(40%)	868(47%)	0.001	26th
27	Restoration of properties, essential services and infrastructure damaged by the building collapse	0	93(3%)	248(13%)	899(48%)	620(33%)	4.01	5th

Table 4.16 shows the respondents' views on the processes for the management of building collapse risks in the study area. The table shows that out of twenty seven processes examined only eleven were effectively applied in the reduction of the impact building collapse risks in the study area using the average mean as basis of analysis. The table shows that only eleven processes met the cut-off point and hence were accepted as processes that are effectively applied in the management of building collapse risks, while sixteen other processes did not meet the cutoff point showing even though, they are means of managing building collapse risks, they are not effectively applied by the management agencies in the management of building collapse risks in the study area. The table reveals that prevention or avoidance of losses from building collapse (4.81), recovery of dead bodies and their disposal (4.25), maintenance of law and order (4.16), provision of Medicare for the injured (4.11), restoration of properties, essential services and infrastructure damaged by the building collapse (4.01),

bringing order to a chaotic situation (3.97), prompt assistance to the victims (3.69), provision of temporary accommodation and feeding (3.61), rapid and effective recovery of affected victims (3.60), establishment of institutions and agencies to take care of emergency related issues/events (3.55) and proper funding of disaster management structures across the country (3.30) are the processes effectively adopted in the management of building collapse risks. The analysis above shows that even though some processes for management of building collapse risks in the study area are being effectively applied, there are many other processes that are not effectively operational which still make the management of building collapse risks not attain the desired level of effectiveness.

4.1.6 Impact of Building Collapse Risks on the Nigerian economy

This section provides data on the impact of building collapse risks on the Nigerian economy. The impacts were classified into six categories as follows Economic/Financial risks, Socio-Political risks, Human related risks, Environmental risks, Physical risks and Law/legal risks. Table 4.6 shows the responses on the impacts of these risks on the Nigerian economy

Table 4.17: Response on the Impact of Building Collapse Risks on the Nigerian economy

S/NO	Economic/Financial Risks	SA	A	U	D	SD	Mean	Rank
1.	Loss of property	1612(87%)	186(10%)	31(2%)	31(2%)	0	8.12	1st
2	Loss of annual income/capital investment	1178(63%)	558(30%)	62(3%)	62(3%)	0	6.37	4th
3	Loss of materials	1240(67%)	465(25%)	62(3%)	93(5%)	0	6.72	2nd
4	Bankruptcy of investor or developer	465(25%)	868(47%)	372(20%)	155(8%)	0	4.21	17th
5	Decrease in the contributions of real estate sector to the nation's GDP	558(30%)	1054(57%)	186(10%)	124(7%)	0	4.40	15th
6	Loss of life investment	713(38%)	744(40%)	279(40%)	124(7%)	0	4.9	7th
7	Increase in the cost of maintenance	434(23%)	868(47%)	248(13%)	217(11%)	93(5%)		

8	Shortage in the supply of real estate facilities	589(32%)	744(40%)	155(8%)	310(16%)	62(3%)	4.50	14th
9	Clean up costs	589(32%)	837(45%)	310(16%)	93(5%)	31(2%)	4.53	13th
10	Rescue costs	589(32%)	868(47%)	279(15%)	124(7%)	0	4.55	12th
11	Cost of investigation/compensation	651(35%)	930(50%)	217(12%)	62(3%)	0	4.77	9th
12	Treatment of injured people	620(33%)	1054(57%)	186(10%)	0	0	4.71	10th
13	Cost of rebuilding/repair	1054(57%)	713(37%)	93(5%)	0	0	6.09	5th
14	Cost of loss of functionality	403(22%)	1116(60%)	341(18%)	0	0	4.02	19th
15	Cost of replacement/repair of its contents	682(36%)	899(48%)	217(11%)	62(3%)	0	4.81	8th
16	Cost of temporary relocation	620(33%)	961(52%)	217(11%)	62(3%)	0	4.70	11th
17	Regional economic effects	558(30%)	899(48%)	248(13%)	124(7%)	31(2%)	4.37	16th
18	Waste of resources, time and labour	1209(65%)	465(25%)	155(8%)	0	31(2%)	6.64	3rd
19	Cost of legal dispute	775(42%)	806(43%)	217(12%)	62(3%)	0	5.10	6th
	Socio-Political Risks	SA	A	U	D	SD	Mean	Rank
1	Loss of reputations and integrity of the contractors	1488(80%)	217(12%)	93(5%)	62(3%)	0	7.92	1st
2	Psychological trauma and shocks	1240(67%)	434(23%)	124(7%)	62(3%)	0	6.68	2rd
3	Loss of new commission and contracts	682(37%)	713(38%)	341(18%)	93(5%)	31(2%)	5.58	7th
4	Withdrawal of practicing licenses	775(42%)	620(33%)	217(12%)	124(7%)	124(7%)	5.71	6th
5	Loss of trust	930(50%)	682(37%)	186(10%)	62(3%)	0	6.31	4th
6	Discourages investment in property development	496(27%)	775(42%)	248(13%)	217(12%)	124(7%)	4.98	10th
7	Loss of jobs	620(33%)	713(38%)	217(12%)	217(12%)	93(5%)	5.43	8th

8	Scarcity of property	434(23%)	775(42%)	248(12%)	310(17%)	93(5%)	4.79	12th
9	Loss of prestige of the owner	589(32%)	651(35%)	372(20%)	186(10%)	62(3%)	5.21	9th
10	Shortage of manpower	217(12%)	465(25%)	465(25%)	434(23%)	279(15%)	4.24	13th
11	De-marketing the values of industry professionals	434(23%)	837(45%)	279(15%)	217(12%)	93(5%)	4.86	11th
12	Portrays the Nigeria	806(43%)	589(32%)	341(18%)	93(5%)	31(2%)	5.83	5th
	building industry as being corrupt							
13	Professionals' marketability to Foreign firms /clients has been devalued	1116(60%)	465(25%)	186(10%)	93(5%)	0	6.55	3rd
	Human Related Risks	SA	A	U	D	SD	Mean	Rank
1	Loss of lives	1395(75%)	372(20%)	62(3%)	31(2%)	0	7.64	1st
2	Injuries	1271(68%)	558(30%)	0	31(2%)	0	7.00	2nd
3	Disruption of educational activities	155(8%)	868(47%)	279(16%)	372(20%)	186(10%)	4.00	8th
4	Loss of the contribution from the victims towards the socio-economic growth of the nation	434(23%)	837(45%)	279(15%)	217(12%)	93(5%)	5.20	6th
5	Increase in death rate against the United Nations Millennium Development Goals (MDGs)	403(22%)	930(50%)	279(15%)	186(10%)	62(3%)	4.90	7th
6	Leads the victims to permanent disability	775(42%)	589(32%)	341(18%)	93(5%)	62(3%)	5.89	4th
7	Psychological damage (fear, helplessness, distress, depression and suicides)	806(43%)	806(43%)	155(8%)	93(5%)	0	6.44	3rd
8	Disruption of economic activities	465(25%)	1023(55%)	124(6%)	217(12%)	31(2%)	5.31 5th	

	Environmental Risks	SA	A	U	D	SD	Mean	Rank
1	Provides hideouts for robbers and hoodlums	620(33%)	868(47%)	186(10%)	186(10%)	0	5.51	4th
2	Place of abode for dangerous animals like snakes	868(47%)	806(43%)	155(8%)	93(5%)	0	6.02	1st
3	Environmental damage	651(35%)	930(50%)	124(6%)	124(6%)	62(3%)	5.70	3rd
4	Loss of functionality in the neighborhoods	434(23%)	899(48%)	279(15%)	186(10%)	62(3%)	5.12	6th
5	CO_2 Emissions/Pollution	341(18%)	527(28%)	434(23%)	465(25%)	93(5%)	4.39	8th
6	Reduction in the energy use	279(15%)	589(32%)	465(23%)	341(18%)	186(10%)	4.24	9th
7	Increase in toxic emission	186(186%)	682(37%)	496(27%)	310(17%)	186(10%)	4.01	10th
8	Environmental studies/repair	403(21%)	682(37%)	434(23%)	279(15%)	62(3%)	5.00	7th
9	Loss of building aesthetic values	589(32%)	899(48%)	155(8%)	124(6%)	93(5%)	5.31	5th
	Physical Risks	SA	A	U	D	SD	Mean	Rank
1	Structural damage	1240(67%)	465(25%)	155(8%)	0	0	6.72	1st
2	Damage to contents	899(48%)	930(50%)	31(2%)	0	0	5.31	2nd
3	Loss of functionality	651(35%)	1085(58%)	124(6%)	0	0	5.20	5th
4	Replacement/repair of structure	837(45%)	713(38%)	248(13%)	62(3%)	0	5.28	3rd
5	Replacement/repair of contents	589(32%)	806(43%)	279(15%)	186(10%)	0	4.86	8th
6	Temporary relocation	620(33%)	868(47%)	341(18%)	31(2%)	0	4.91	7th
7	Loss of strength of the building	806(43%)	620(33%)	155(8%)	124(6%)	155(8%)	5.24	4th

8	Shortage of manpower	341(18%)	651(35%)	434(23%)	186(10%)	248(13%)	4.58	11th
9	Increment of sick citizens	248(13%)	682(37%)	434(23%)	372(20%)	124(6%)	4.32	12th
10	Street blockage	341(18%)	837(45%)	465(25%)	186(10%)	31(2%)	4.62	10th
11	Evacuation difficulty	620(33%)	930(50)	155(5%)	124(6%)	31(2%)	4.99	6th
12	Travel distance increment	248(13%)	620(33%)	589(32%)	310(17%)	93(5%)		13th
13	Damage of materials beyond re-use	496(27%)	868(47%)	341(18%)	124(6%)	31(2%)	4.70	9th
14	Loss of fauna and flora	155(8%)	806(43%)	341(18%)	372(20%)	186(10%)	4.01	14th

	Law/Legal Risks	SA	A	U	D	SD	Mean	Rank
1	Exasperation of crises among stakeholders	775(42%)	806(43%)	155(8%)	124(6%)	0	5.20	3rd
2	Legal tussle among stakeholders	837(45%)	806(43%)	155(5%)	62(3%)	0	5.45	1st
3	Arbitration/Mediation to resolve crises arising from building collapse	744(40%)	837(45%)	186(10%)	93(5%)	0	5.15	4th
4	Conflicts resolution	713(38%)	806(43%)	217(12%)	93(5%)	31(2%)	4.91	5th
5	Apportioning blames and arbitrary words of mouth among the stakeholders	775(42%)	868(47%)	124(6%)	93(5%)	0	5.34	2nd

Source: Field Survey, 2018

The analysis in Table 4.17 shows the respondents' views on the six classifications of the impacts of building collapse risks on the Nigerian economy. The analysis of these classifications is as follows:

Economic/Financial Risks: The respondents' views on the impact of economic/financial risks on the Nigerian economy show that loss of property (8.12) tops the list, followed by loss of materials (6.72), waste of resources, time and labour (6.64), Loss of annual income/capital investment (6.37), Cost of rebuilding/repair (6.09), Cost of legal dispute (5.10), Loss of life investment (4,9), Cost of replacement/repair of its content (4.81), Cost of investigation/compensation (4.77), Treatment of injured people (4.71), Cost of temporary

relocation (4.70), Rescue costs (4.55), Clean up costs (4.53), Shortage in the supply of real estate facilities (4.50), Decrease in the contributions of real estate sector to the nation's GDP (4.40), Regional economic effects (4.37) and lastly Bankruptcy of investor or developer (4.21). The above views of respondents reveal that the most of the sub-factors have significant impact on the Nigerian economy..

Socio-Political risks: The socio-political sub-factors that negatively impact on the Nigerian economy are: loss of reputations and integrity of the contractors (7.92), psychological trauma and shocks (6.68), professionals' marketability to foreign firms/clients has been devalued (6.55), loss of trust (6.31). portrays Nigerian building industry as being corrupt (5.83), Withdrawal of practicing licenses (5.71), loss of new commission and contracts (5.58), loss of jobs (5.43), loss of prestige of the owner (5.21), discourages investment in property development (4.98), demarketing the values of industry professionals (4.86), scarcity of property and finally shortage of manpower (4.24). The above analysis reveals that loss of reputations and integrity of the contractors has the most significant impact followed by psychological trauma and shocks, professionals' marketability to foreign firms/clients has been devalued, loss of trust and lastly shortage of manpower

Human Related risks: The Table 4.11 shows the respondents views on the human related risk factors that impede in the Nigerian economy. The table reveals that the significant factors and the extent of the their impact include; loss of lives (7.64), injuries (7.00), psychological damage (6.44), leads victims to permanent disability (5.89), disruption of economic activities (5.31), loss of contribution from the victim towards economic growth of the nation (5.20), increase in the death rate against the United Nations Millennium Development Goals (4.90) and lastly disruption of educational activities (4.00).. This implies that all the factors significantly impact in the Nigerian economy, with loss of lives ranking first, Injuries (2^{nd}), psychological damage (3^{rd}), leads victims to permanent disability (4^{th}), while the least is disruption of educational activities (8^{th})

Environmental Risks: From the table 4.11 it shows that all the sub-factors from environmental risks impact significantly on the Nigerian economy. The table reveals that Place of abode for dangerous animals like snakes was ranked 1^{st} as the most significant impact, degrading of the environment (2^{nd}), environmental damage (3^{rd}), provides hideouts for robbers and hoodlums (4^{th}), loss of building aesthetic values (5^{th}), while increase in toxic emission (10^{th}) was ranked last.

Physical Risks: The analysis in Table 4.11 shows the level of impact of physical risk factors on the Nigerian economy. The sub-factors impact individually as follows: structural damage (6.72), damage to contents (5.31), replacement/repair of structure (5.28), loss of strength of building (5.24), loss of functionality (5.20), evacuation difficulty (4.99) temporary relocation (4.91), replacement/repair of contents (4.86), damage of materials beyond re-use (4.70), street blockage (4.62), shortage of manpower (4.58), increment of sick citizens (4.32), travel distance increment (4.21) and lastly loss of fauna and flora (4.10). The above analysis implies that all the sub-factors have significant effect on the stakeholders in the built environment and were ranked as follows: structural damage (1^{st}), damage to contents (2^{nd}), replacement/repair of structure (3^{rd}), loss of strength of building (4^{th}), loss of functionality (5^{th}), while loss of fauna and flora was ranked the 14^{th} position. The above analysis further reveals that physical risks impact negatively on the Nigerian economy.

Law/legal Risks: In the Table 4.11, the analysis shows how the law/legal risk factors impact on the Nigerian economy. The table reveals that the sub-factors impact on the stakeholders as follows: legal tussle among stakeholders (5.45), apportioning blames and arbitrary words of mouth among the stakeholders (5.34), Exasperation of crises among stakeholders (5.20), arbitration/mediation to resolve crises arising from building collapse and lastly conflicts resolution (4.91). The table further reveals that legal tussle among stakeholders was ranked 1^{st}, apportioning blames and arbitrary words of mouth among the stakeholders (2^{nd}), exasperation of crises among stakeholders (3^{rd}), arbitration/mediation to resolve crises arising from building collapse (4^{th}) , while conflicts resolution has least impact (5^{th}).The above analysis shows that law/legal risks actually impact significantly on the Nigerian economy.

The above analysis concurs with Janssens et al (2010) which state that the consequences of building collapse affect the occupants and inhabitants of the neighbourhood.
However, Principle Component Analysis (PCA) was carried out to further investigate the key factors that impact in the Nigerian economy. Tables 4.18 – 4.21 show the results of the analysis.

Table 4.18: Principal component analysis on Economic/Financial Risks that impact on the Nigerian economy.

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Economic/Financial Risks	765.2157	178.66210	19
Socio-Political Risks	755.9100	182.00344	13

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.600
Bartlett's Test of Sphericity	Approx. Chi-Square	3.408
	Df	1
	Sig.	.006

Communalities

	Initial	Extraction
Economic/Financial Risks	1.000	.725
Socio-Political Risks	1.000	.699

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.600
Bartlett's Test of Sphericity	Approx. Chi-Square	3.408
	Df	1

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Economic/Financial Risks	.721
Socio-Political Risks	.716

Extraction Method: Principal Component Analysis.

a.1 components extracted.

From the analysis above it shows that Economic/Financial Risks has a greater impact in the Nigerian economy since the probability value (0.006) is less than the alpha value (0.05). The analysis also shows that the Economic/Financial Risks has a greater impact on building collapse risks in the Nigerian economy with a principal component of 0.721.

Table 4.19: Principal component analysis on Socio-Political Risks that impact on the Nigerian economy

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Socio-Political Risks	755.9100	182.00344	13
Human Related Risks	713.5000	144.67501	8

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Adequacy.	Measure of Sampling	.700
Bartlett's Test Sphericity	of Approx. Chi-Square	3.77
	Df	1
	Sig.	.014

Communalities

	Initial	Extraction
Socio-Political Risks	1.000	.725
Human Related Risks	1.000	.699

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
Socio-Political Risks	.716
Human Related Risks	.688

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

From the analysis above it shows that Socio-Political Risks has a greater impact in the nation economy since the probability value (0.014) is less than the alpha value (0.05). The analysis also shows that the

Socio-Political Risks has an impact on building collapse risks on the nation economy with a principal component of 0.716.

Table 4.20: Principal component analysis on Human Related Risks that impact in the Nigerian economy.

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Human Related Risks	713.500	144.67501	8
Physical Risks	577.921	95.130166	14

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	.092
	Df	1
	Sig.	.031

Communalities

	Initial	Extraction
Human Related Risks	1.000	.661
Physical Risks	1.000	.572

Extraction Method: Principal Component Analysis.

Component Matrix [a]

	Component
	1
Human Related Risks	.688
Physical Risks	.636

Extraction Method: Principal Component Analysis.

a 1 components extracted.

From the analysis above it shows that Human Related Risks has an impact in the nation economy since the probability value (0.031) is less than the alpha value (0.05). The analysis also shows that the Human Related Risks has an impact in the Nigerian economy with a principal component of 0.688.

Table 4.21: Principal component analysis on Environmental risks that impact on the Nigerian economy.

Descriptive Statistics

	Mean	Std. Deviation	Analysis N
Environmental Risks	502.299	167.0512	10
Law/legal risk	768.809	159.0012	5

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.500
Bartlett's Test of Sphericity	Approx. Chi-Square	.092
	Df	1
	Sig.	.039

Communalities

	Initial	Extraction
Environmental Risks	1.000	.533
Law/legal risk	1.000	.502

Extraction Method: Principal Component Analysis.

Component Matrix [a]

	Component
	1
Environmental Risks	.533
Law/legal risk	.502

Extraction Method: Principal Component Analysis.

a 1 components extracted.

From the analysis above it shows that Environmental Risks has an impact in the nation economy since the probability value (0.039) is less than the alpha value (0.05). The analysis also shows that the Environmental Risks has an impact in the nation economy with a principal component of 0.533.

From the analysis it shows that Economic/Financial Risks has the highest impact in the Nigerian economy with a probability value of 0.006 and a principal component value of 0.721, followed by

Socio-Political Risks with a probability value 0.014 and a principal component value of 0.716. The third factor is Human Related Risks of probability value 0.031 and a principal component of 0.688. Then the fourth is Physical Risks with a principal component value of 0 .636. The fifth factor is Environmental Risks with a probability value of 0.039 and principal component of 0.533. The analysis shows that the least factor impacting in the Nigerian economy is Law/legal risk with a principal component of 0.502.

4.1.7 Challenges faced by the Emergency Management Agencies in the Management of Building Collapse Risks in Nigeria

This section presents and analyzed data on the challenges faced by the emergency management agencies in the management of building collapse risk practices in Nigeria. Table 4.22 shows the extent of agreement on the challenges faced by the management agencies in the management of building collapse risks in Nigeria.

Table 4.22: Responses on the challenges faced by the Management Agencies in the Management of Building Collapse Risks in Nigeria

S/No	Response Option	SA	A	U	D	SD	RII	Rank
1	Lack of coordination and control of the activities of stakeholders in disaster management	837(45%)	806(43%)	155(5%)	62(3%)	0	0.86	2nd
2	Insincerity on the part of the government to provide emergency services	837(45%)	713(38%)	248(13%)	62(3%)	0	0.85	4th
3	Lack of adequate funding and equipment	1116(60%)	465(25%)	186(10%)	93(5%)	0	0.88	1st
4	Poor attitudinal disposition of Nigerians towards emergency situations	496(27%)	775(42%)	248(13%)	217(12%)	124(7%)	0.74	10th
5	Perceive ofdisaster occurrence as "the wrath of the gods"	620(33%)	713(38%)	217(12%)	217(12%)	93(5%)	0.77	7th
6	Absence of disaster training platforms	434(23%)	775(42%)	248(12%)	310(17%)	93(5%)	0.72	14th
7	Bureaucratic bottlenecks in obtaining emergency assistance	589(32%)	651(35%)	372(20%)	186(10%)	62(3%)	0.76	9th
8	Lack of or ineffective Disaster Management Information System (DMIS)	517(12%)	465(25%)	365(25%)	234(23%)	279(15%)	0.68	15th
9	Poor Urban Planning	434(23%)	837(45%)	279(15%)	217(12%)	93(5%)	0.74	10th
10	Inadequate Policy Framework	806(43%)	589(32%)	341(18%)	93(5%)	31(2%)	0.82	5th
11	Limited insurance covers	386(20%)	682(37%)	296(16%)	310(17%)	186(10%)	0.68	14th

12	Inadequate support facilities and services	403(21%)	682(37%)	434(23%)	279(15%)	62(3%)	0.72	12th
13	Weak co-operative efforts from occupants and neighbourhood inhabitants	775(42%)	589(32%)	341(18%)	93(5%)	31(5%)	0.80	6th
14	Lack of collaboration among management agencies and the stakeholders	651(35%)	1085(58%)	124(6%)	0	0	0.86	3rd
15	Negligence on the part of management agencies	470(25%)	770(41%)	496(27%)	100(5%)	24(1%)	0.77	7th

Table 4.22 shows the respondents' ratings of the challenges faced by the management agencies in the management of building collapse risks in Nigeria. The table reveals that 60% and 25% of the respondents strongly agreed and agreed that lack of adequate funding affects the management of building collapse risks in Nigeria, while 10% of the respondents were undecided, where 5% of the respondents disagreed to the assertion. The respondents however rated the option as the first most important challenge faced by the management agencies in the management of building collapse risks in Nigeria. Lack of proper coordination of disaster management activities was ranked the second most important factor affecting management of building collapse risks (0.86), where 45% and 43% of the respondents strongly agreed/agreed respectively to the response option. However, only 5% of the respondents were undecided while only 3% and 0% of the respondents disagreed/strongly disagreed to the assertion. Lack of collaboration among management agencies and stakeholders were ranked the third most important factor (0.86) affecting the management of building collapse risks where 35% and 58% strongly agreed/agreed to the response option while only 6% of the respondents were undecided. None of the respondents either disagreed or strongly disagreed to the response option. 45% and 38% of the respondents strongly agreed/agreed that insincerity on the part of government to provide emergency services affect management of building collapse risk practices in Nigeria while only 3% of the respondents were undecided. Again 3% of the respondents disagreed to the assertion. However the respondents ranked this option as the 4th most important factor (0.86) affecting management of building collapse risks practices in Nigeria. The respondents also strongly agreed/agreed (43% and

32%) that inadequate policy framework affects management of building collapse risks, only 12% and 5% of the respondents disagreed/strongly disagreed to the response option. However the option was rated as the 5th most important challenge to the management agencies in the management of the building collapse risk in the study area. The respondents rated weak co-operative efforts from the occupants and neighborhood inhabitants the 6th most important factor (0.80) that affect management of building collapse risk as 74% (42% and 32%) agreed that it is an important factor while 10% disagreed to the response to the response option. 71% (33% and 38%) of the respondents affirmed that perception of disaster occurrence as the wrath of the goods as a factor affecting management of building collapse risk while 17% (12% and 5%) disagreed to the response option. The respondents rated negligence on the part of emergency management agencies as the 8th most important factor where 67% (25% and 42%) of the respondents agreed to the option while 6% of the response was in the negative. 67% (32% and 35%) affirmed that bureaucratic bottleneck in obtaining emergency assistance affects management of building collapse risk while 13% (10% and 3%) did not uphold the option. However the respondents rated the option as the 9th (0.76) most important challenge affecting management of risks associated with building collapse. Poor attitudinal disposition of Nigerians towards emergency situations was rated the 10th (0.74) most important challenge affecting management of building collapse risks where 69% (27% and 42%) of the respondents were in agreement with the assertion and 19% (12% and 7%) of the respondents disagreed, poor urban planning also has the same rating as 0.74 the most important factor affecting management where 69% of the respondents response was in the affirmative while only 19% (12% and 7%) was in disagreement with the view. Absence of disaster training platform was also rated to be the 12th (0.72) most important factor affecting management of building collapse risks in Nigeria as the majority of the respondents 65% (23% and 42%) agreed to the statement while only 22% (17% and 5%) disagreed. Also inadequate support facilities and services was rated as the 12th (0.72) most important affecting factor as 58% (21% and 37%) of the respondents agreed to the assertion while only 18% (15% and 3%) were in disagreement with the assertion. Limited Insurance covers was rated the 14th (0.68) most important factor affecting the management of building collapse risks in Nigeria as 57% (20% and 37%) agreed to the opinion while 27% (17% and 10%) of the respondents were in disagreement with the response option. Lack of or ineffective Disaster Management Information System (DMS) was rated the 15th (0.59) most important factor affecting management of building collapse risks in Nigeria Where 53% (28% and 25%) of the respondents agreed to the option while 27% (20% and 7%) of the respondents

disagreed with the response option. The implication of the above analysis is that all the factors considered affect the management agencies in the management of building collapse risks in Nigeria as more than 50% of the respondents affirmed all the options and the ratings of the respondents of all the factors are also up to 0.5

4.1.8 Critical Success Factors for Effective Management of Building Collapse Risks in Nigeria

This section provides and analyses data on critical success factors for effective management of building collapse in Nigeria. Table 4.23 shows the ratings of the extent of effectiveness of the considered measures towards ensuring effective management of building collapse risks in Nigeria

Table 4.23: Response Ratings on Critical Success Factors for Effective Management of Building Collapse Risks in Nigeria.

S/No	Response Option	VE	E	U	I	VI	RII	Rank
1	Establishment of functional disaster management institutions at all levels of governance	1116(60%)	620(34%)	62(3%)	62(3%)	0	0.90	2nd
2	Develop the capacity of relevant institutions and stakeholders for effective and efficient management of building collapse risks	1054(57%)	465(25%)	248(13%)	62(3%)	31(1%)	0.86	3rd
3	Coordination and control of the activities of all stakeholders in disaster management	806(43%)	434(23%)	372(20%)	186(10%)	62(3%)	0.79	9th

4	Monitor the state of preparedness of all organizations and agencies which may contribute to the management of building collapse risks	1023(55%)	558(30%)	186(10%)	62(3%)	31(2%)	0.87	4th
5	Educate the public on the prevention and control measures of building collapse risks	62(33%)	868(47%)	248(13%)	62(3%)	62(3%)	0.51	15th
6	Coordinate and support the activities of non-governmental organizations engaged in the management of building collapse risks	992(53%)	558(30%)	186(10%)	62(3%)	62(3%)	0.85	7th
7	Mobilize financial and technical resources from	403(22%)	806(43%)	496(27%)	124(6%)	31(1%)	0.75	14th
	private sector and international non-governmental organizations							
8	Establishment of disaster management volunteers in both rural and urban areas	992(53%)	558(30%)	186(10%)	65(4%)	59(3%)	0.85	5th
9	Training of emergency management personnel in different types of emergency situations	775(42%)	744(40%)	248(13%)	62(3%)	31(1%)	0.83	10th
10	Provision of relevant rescue equipment and trained personnel	465(25%)	775(42%)	496(27%)	124(7%)	31(1%)	0.77	13th

11	Policy review of the emergency agencies to simplify their hitherto bureaucratic procedures of operation	527(28%)	1023(55%)	186(10%)	93(3%)	31(1%)	0.81	12th
12	Adequate funding and monitoring of the activities of all emergency management agencies (NEMA, SEMA,LEMA, Fire service, Red Cross Society, NGO's, etc	1118(60%)	618(33%)	62(2%)	62(2%)	0	0.91	1st
13	Creation of adequate emergency management awareness to the Nigerian populace, both rural and urban areas	742(39%)	870(47%)	155(8%)	62(2%)	31(1%)	0.84	11th
14	Prompt and appropriate assistance to victims of	992(53%)	558(30%)	188(10%)	62(2%)	60(2%)	0.85	6th
	building collapse							
15	Establishment of collaborative network of all the stakeholders.	806(43%)	434(23%)	372(20%)	186(10%)	62(2%)	0.79	8th

Table 4.23 shows the respondents ratings of the important critical success factors for the management of building collapse risks in Nigeria. The table reveals that 93% (60% and 33%) affirmed that adequate finding and monitoring of the activities of all emergency management agencies is very critical to successful management of building collapse risks in Nigeria while only 2% of the respondents disagreed to the assertion. However, the factories ranked/rated the first (0.91) most important critical success factor in achieving effective management of building collapse risks in Nigeria. Establishment of functional disaster management institutions at all levels of governance was rated the second (0.90) most important success factor using RII as 94% (60% and 34%) of the respondents agreed to the statement while only 3% of the respondent disagreed. 85% (55% and 30%) of the respondents affirmed that monitoring the state of preparedness of all organizations and agencies responsible for management of building collapse risk will ensure success in management of building

collapse risks while only 5% of the respondents disagreed to the assertion. However the factor was rated the 3rd (0.87) most important factor in achieving successful management of building collapse risk. Developing the capacity of relevant institutions and stakeholders for effective and efficient management of building collapse risks was rated the 4th (0.86) most important factor as 82% (57% and 25%) agreed to the option while 4% of the respondents disagreed to the option. Coordinating and supporting the activities of non-government organizations engaged in management of building collapse risks by government establishment of disaster management volunteers in both rural and urban areas and provision of prompt and appropriate assistance to victim of building collapse tied in rank as the 5th (0.85) most important success factor in achieving sustainable management of building collapse risk in Nigeria. Again co-ordination of the activities of all stakeholders in disaster management and establishment of collaborative network of all the stakeholders tied in rank as the 8th (0.79) most critical success factor in ensuring efficient management of building collapse risks in Nigeria. 86% (47% and 39%) of the respondents agreed that creation of adequate emergency management awareness to the Nigerian populace, both in rural and urban areas will ensure successful management of building collapse risks, only 3% (2% and 1%) disagreed to the response option while 8% of the respondents were undecided. However the above response option was ranked the 10th (0.84) most important factor. Training of emergency management personnel in different types of emergency situations was ranked the 11th (0.83) most important factor as 82% (42% and 40%) of the respondents agreed to the response option while 13% were undecided and 4% (3% and 1%) disagreed to the response option. 83% (28% and 55%) agreed that reviewing the policies establishing the emergency management agencies to simplify their hitherto bureaucratic procedures of operation will ensure successful management of building collapse risks, 10% of the respondents were undecided while 4% (3% and 1%) disagreed to the response option. The option was also ranked the 12th most critical success factor in achieving efficient/effective management of building collapse risks. Provision of relevant rescue equipment and trained personnel was ranked the 13th (0.77) critical success factor as 67% (25% and 42%) of the respondents agreed to the assertion, 27% of the respondents were undecided while only 8% (7% and 1%) of the respondents disagreed to the option. 66% of the respondents agreed that mobilizing financial and technical resources from private sector and international non-governmental organizations will ensure successful management of building collapse risks 27% of the respondents were undecided while 7% (6% and 1%) of the respondents disagreed to the option. The option was also rated the 14th (0.75) critical success factor. Educating the public

on the prevention and control measures of building collapse risks was rated the 15th (0.51) most critical success factor as 80% of the respondents agreed to the response option, 10% of the respondents were undecided while 6% 93% and 3%) disagreed to the response option. The implication of the above analysis is that all the factors considered were selected as critical success factors for efficient/effective management of building collapse risks in Nigeria as more than 50% of the respondents agreed to each of the factor considered and the RII figures more than 0.5. However, in other to pinpoint the most critical success factor all the factors were subjected to factor analysis (Principal Component Analysis) and the result shown in table 4.24 below.

4.1.9 Principal Component Analysis (PCA) on Critical Success Factors for Effective Management of Building Collapse Risks in Nigeria.

In this section, the Critical Success Factors for Effective Management of Building Collapse Risks in Nigerian were collapsed into few factors using PCA to determine the most critical factors as shown in table 4.24.

Table 4.24: Critical Success Factors for Effective Management of Building Collapse Risks in Nigeria

		KMO and Bartlett's Test (Sig)	Principal Component Analysis value	Ranking
	Adequate funding and monitoring of the activities of all emergency management agencies (NEMA, SEMA,LEMA, Fire service, Red Cross Society, NGO's,	.001	.788	1st

	Establishment of functional disaster management institutions at all levels of governance	.023	.743	2nd
	Develop the capacity of relevant institutions and stakeholders for effective and efficient management of building collapse risks	.028	.722	3rd
	Monitor the state of preparedness of all organizations and agencies which may contribute to the management of building collapse risks	.034	.699	4th
	Establishment of disaster management volunteers in both rural and urban areas	0.29	.677	5th
	Prompt and appropriate assistance to victims of building collapse	0.25	.651	6th
	Coordinate and support the activities of non-governmental organizations engaged in the management of building collapse risks	0.21	621	7th
	Establishment of collaborative network of all the stakeholders.	0.20	591	8th

From the analysis above, it shows that the most critical factors for effective management of building collapse risks in Nigeria is through Adequate funding and monitoring of the activities of all emergency management agencies (NEMA, SEMA,LEMA, Fire service, Red Cross Society, NGO's, followed by Establishment of functional disaster management institutions at all levels of governance, Develop the capacity of relevant institutions and stakeholders for effective and efficient management of building collapse risks and then Monitor the state of preparedness of all organizations and agencies which may contribute to the management of building collapse risks

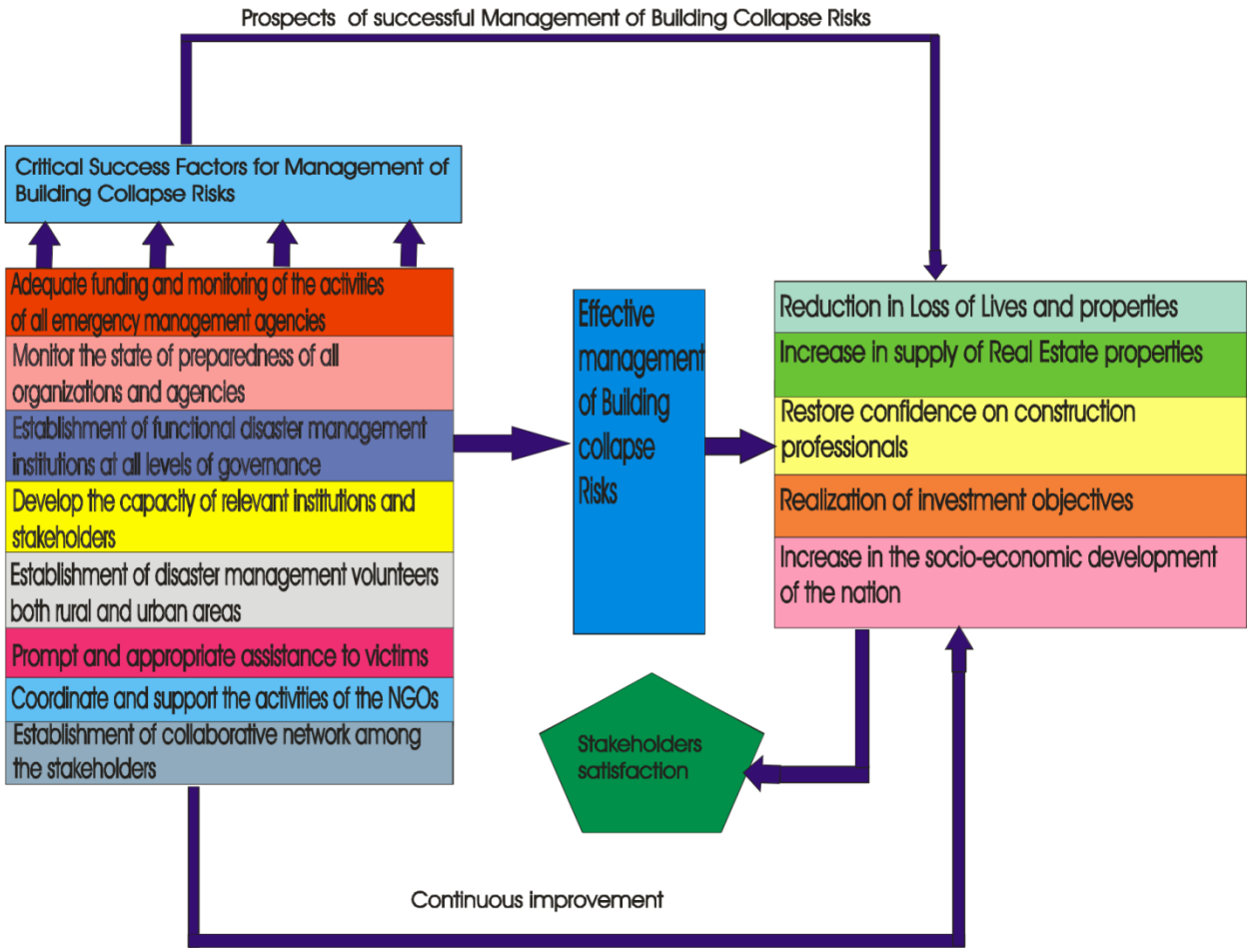


Figure 4.5: Developed framework for Effective Management of Building Collapse Risks in Nigeria.

4.1.10 Framework Validation

Frameworks are usually developed to address some specific problems in the real life situations. These frameworks cannot be used with confidence to solve such problems unless they are validated. Validators are required to rate the aspects of the framework.

In validating the framework, a closed-ended questionnaire was designed and administered to 50

respondents purposefully selected from the respondents of the main study; Project Managers were involved because of their role in the project implementation process. A total of 42 validating instruments were duly completed and returned consisting of Architects (08), Builders (06), Engineers (12), Quantity Surveyors (05), Town Planners (05) and Project Managers (06). The respondents were asked to rate some key aspects of the framework and the data was analyzed using the mean score after which the percentages were obtained in order to determine the validity and reliability of the framework. The results are presented in Table 4.25.

Table 4.25: Percentage scores of key aspects of the framework

Clarity of the framework		(6)14%	(26)62%	(10)24%	
Logicality of the framework		(2)05%	(32)76%	(8)19%	
Comprehensiveness of the framework		(2)05%	(12)28%	(20)48%	(8)19%
Applicability to project management		(8)19%	(24)57%	(10)24%	
Practical relevance to the concept of risk management		(8)19%	(26)62%	(8)19%	
Overall contribution to success of managing building collapse risks		(16)38%	(24)57%	(2)05%	
Key aspects of the framework	**1-Poor**	**2-Fair**	**3-Satisfactory**	**4-Good**	**5-Excellent**

The percentage scores indicated that none of the items of validation was scored poor and each received at least one excellent score. For instance, 76% respondents rated the framework as good in terms of logical structure while comprehensiveness of the framework was rated good by

48%. Similarly, clarity of the framework and applicability to project management were rated excellent by 24% each while 05% of the respondents opined that the framework would excellently contribute to the success of managing building collapse risks. A further look at the individual scores indicates that only two validators rated the comprehensiveness of the framework as fair which showed that the framework is valid and credible. Based on the

results of the validation, it can then be concluded that the framework can be applied with confidence in addressing risks associated with building collapse.

4.1.11 Analysis of the Effectiveness of the Existing Systems of Managing building Collapse Risks in Nigeria.

Table 4.26 : Effectiveness of the existing systems of managing building collapse risks in Nigeria

S/N	Response Option	Poor = 1	Fair = 2	Satisfactory = 3	Good = 4	Excellent = 5	Mean	Rank

1	Clarity of the framework	837 (45%)	775 (42%)	248 (13%)	0	0	1.68	2
2	Logicality of the framework	558 (30%)	920 (50%)	186 (10%)	155 (8%)	31 (2%)	2.01	3
3	Comprehensiveness of the framework	1023 (55%)	651 (35%)	155 (8%)	31 (2%)	0	1.57	1
4	Applicability to project management	434 (23%)	837 (45%)	279 (15%)	217 (12%)	93 (5%)	2.30	6
5	Practical relevance to the concept of risk management	837 (45%)	310 (17%)	372 (20%)	217 (12%)	124 (7%)	2.18	5
6	Overall contribution to success of managing building collapse risks	527 (28%)	837 (45%)	279 (15%)	217 (12%)	0	2.10	4
	Average mean score						1.97	

Table 4.26 shows the percentage scores of the key aspects of the framework. The scores indicated that majority of the items of validation had a high scores of either poor or fair. For instance in the comprehensiveness of the framework, 55% respondents rated it poor and 35% rated it fair. Similarly, 45% respondents rated the framework poor in terms of clarity while 45% rated the framework fair in terms of applicability to project management. A close look at the framework shows that only 20% of the respondents rated it satisfactory with respect to practical relevance to the concept of risk management. The overall assessment of the framework showed an average mean score of 1.97 as against 3.0 which is poor and not credible. Therefore, it can be concluded that the framework cannot be used to address the

issues of building collapse risks in Nigeria, thereby necessitating the development of a new framework

4.1.12 Analysis of the Effectiveness of the Developed Framework of Managing Building Collapse Risks in Nigeria.

Table 4.27: Effectiveness of the developed framework of managing building collapse risks in Nigeria

S/N	Response Option	Poor = 1	Fair = 2	Satisfactory = 3	Good = 4	Excellent = 5	Mean	Rank
1	Clarity of the framework	0	(14%)	(62%)	(24%)	0	3.10	3
2	Logicality of the framework	0	(5%)	(76%)	(19%)	0	3.14	2
3	Comprehensiveness of the framework	0	(5%)	(28%)	(48%)	(19%)	3.81	1
4	Applicability to project management	0	(19%)	(57%)	(24%)	0	3.05	4
5	Practical relevance to the concept of risk management	0	(19%)	(62%)	(19%)	0	3.00	5
6	Overall contribution to success of managing building collapse risks	0	(38%)	(57%)	(5%)	0	2.67	6
	Average mean score						3.13	

The items of validation in Table 4.27 shows that the respondents rated the framework as being generally satisfactory with the framework recording not less than 50% and recorded excellent result in the comprehensiveness of the framework. 5% of the respondents opined that the framework will contribute to the success of managing building collapse risks in Nigeria. None of the items was scored poor. The average mean score of the respondents is

3.13 which is above average and this is an indication that the framework is valid and credible. With the results of the validation, it can be concluded that the framework is effective and can be applied with confidence in handling building collapse risks in Nigeria.

4.1.13 Comparison between the Existing System and the Developed Model of Managing Building Collapse Risks in Nigeria

The developed framework had been adjudged by the validators as satisfactory, valid, and credible, and can be applied with confidence in addressing risks associated with building collapse in Nigeria, while the existing system according to the validators is poor and not credible. The existing system recorded an average mean score of 1.97 while the developed framework had an average mean score of 3.13 which is satisfactory in the overall ratings. In the developed framework, 19% of the respondents rated the framework as excellent in terms of comprehensiveness while the existing system was rated zero. In terms of ranking the key aspects of the framework based on the records of the validators, applicability to project management with a mean score of 2.30 topped the list, followed by practical relevance to the concept of risk management (2.18), Overall contribution to the success of managing building collapse risks (2.10), logicality of the framework (2.01), Clarity of the framework (1.68) and comprehensiveness of the framework (1.57) was the least. For the developed framework, comprehensiveness of the framework came first with a mean score of 3.81, followed by logicality of the framework (3.14), Clarity of the framework (3.10), Applicability to project management (3.05), Practical relevance to the concept of risk management (3.00) and lastly overall contribution to the success of managing building collapse risks (2.67). A close look at the mean scores of the key aspects of the framework shows that the developed framework recorded above 3.0 while none of the existing system recorded an average mean score. Also, none of the items of rating was rated poor in the developed framework while higher scores were either poor or fair in the existing system. It could be concluded that the developed framework would be very useful in addressing the issues of building collapse risks in Nigeria if applied.

4.1.14 Test of Hypotheses

Test of Hypotheses using One Way Analysis of Variance (ANOVA), factor analysis with the aid of Minitab 18 and Statistical Package for Social Science (SPSS Version 23).

Decision rule: We accept the null hypothesis when the probability value is greater than the alpha value, otherwise we reject it.

Significant level = 0.05

In this analysis, Statistical Package for Social Science (SPSS Version 23) was used in testing hypothesis 1, while Minitab 18 was used in testing hypothesis 2 and One Way ANOVA hypothesis 3.

Hypothesis I

Ho: There is no significance impact of the identified building collapse risks on the Nigerian economy

H_1: There is a significance impact of the identified building collapse risks on the Nigerian economy

Descriptives

variable1

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	Minimum	Maximum	

					95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
					Lower Bound	Upper Bound			
Economic/Financial Risk	19	765.2105	330.67516	75.86209	605.8302	924.5909	403.00	1612.00	
Socio-political Risk	13	755.9231	359.41700	99.68434	538.7296	973.1166	217.00	1488.00	
Human Related Risks	8	713.0000	436.83766	154.44544	347.7946	1078.2054	155.00	1395.00	
Environmental Risks	10	502.2000	208.10831	65.80962	353.3283	651.0717	186.00	868.00	
Physical Rick	14	577.9286	301.93210	80.69475	403.5982	752.2590	155.00	1240.00	
Legal Risk	5	768.8000	45.98043	20.56307	711.7078	825.8922	713.00	837.00	
Total	69	681.5507	324.49955	39.06515	603.5974	759.5040	155.00	1612.00	
Model Fixed Effects			319.66112	38.48268	604.6492	758.4522			
Random Effects				47.02839	560.6604	802.4410			3802.31119

ANOVA

variable1

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	722853.663	5	144570.733	1.415	.031
Within Groups	6437543.410	63	102183.229		
Total	7160397.072	68			

From the analysis above, it shows that the probability value (0.031) is less than the alpha value (0.05), the researcher therefore accept the alternative hypothesis and concludes that there is significance impact of building collapse risks on the Nigerian economy.

Hypothesis II

Ho: The processes employed in the management of building collapse risks in Nigeria have not significantly reduced the impacts of building collapse.

H_1: The processes employed in the management of building collapse risks in Nigeria have significantly reduced the impacts of building collapse.

Factor Analysis: processes

Principal Component Factor Analysis of the Correlation Matrix

Unrotated Factor Loadings and Communalities

Variable Factor1 Factor2 Communality sta -
0.767 -0.641 1.000 C4 0.767 -0.641
1.000
Variance 1.1781 0.8219 2.0000
% Var 0.589 0.411 1.000

Factor Score Coefficients

Variable Factor1 Factor2 sta
-0.651 -0.780 C4 0.651 -
0.780
Factor Score Coefficients

Variable Factor1 Factor2 sta
-0.651 -0.780 C4 0.651
-0.780
Eigenvalue 1.1781 0.8219
Proportion 0.589 0.411
Cumulative 0.589 1.000

p-value 0.6800

From the analysis above, it shows that the probability value (0.05) is greater than the alpha value (0.680), the researcher accept the null hypothesis and concludes that the processes employed in the management of building collapse risks in Nigeria have not significantly reduced the impacts of building collapse.

.

Hypothesis III

Ho: The challenges faced by the management agencies have no significance effect on the management of building collapse risks in Nigeria.

H_1: The challenges faced by the management agencies have significance effect on the management of building collapse risks in Nigeria.

One-way ANOVA:

Source DF SS MS F P
Factor 1 0 0 0.03 0.000
Error 54 3375876 62516 Total 55
3375876

S = 250.0 R-Sq = 0.88% R-Sq(adj) = 0.80%

Individual 95% CIs For Mean Based on
Pooled StDev
Level N Mean StDev ---------+---------+---------+---------+ sta 28 800.8 250.0 (------
------------*-----------------) C3 28 800.8 250.0 (-----------------*-----------------)
---------+---------+---------+---------+ 750 800 850
900

Pooled StDev = 250.0

From the analysis above, it shows that the probability value (0.05) is less than the alpha value (0.0001), the researcher accept the alternative hypothesis and concludes that the challenges faced by management agencies have significance effect on the management of building collapse risk in Nigeria.

Hypothesis IV

Ho: There is no significant difference between the developed model of managing building collapse risks and the existing system

H_1: There is a significant difference between the developed model of managing building collapse risks and the existing system

ANOVA statistics for validation of differences between the developed model of managing building collapse risks and the existing system

	Sum of Squares	Df	Mean Square	F	Sig

Between People	.181	5	.036		
Within Between Items	4.002	1	4.002	21.441	0.006
People Residual	.933	5	.187		
Total	4.935	6	.823		
Total	5.116	11	.465		

Grand Mean = 2.5508

Decision: Reject H_0 since F_{stat} calculated (21.441) is greater than F_{stat}critical (4.844) and p (0.006) <α(0.05) and conclude that there is significant difference between the developed model of managing building collapse risks and the existing system. The result signifies that the developed model for managing building collapse risks and the existing system cannot be the same. The result therefore, indicated that the developed model is more effective in managing the building collapse risks. The result is substantiated by the differences in the average mean scores of the effectiveness of the developed model (3.13) of managing building collapse risks and the existing system (1.97) based on some selected criteria and expert assessment.

4.2 Discussion

4.2.1 Discussion Based on the Specific Objectives

In this section, the results of the analysis were discussed so as to snowball the findings of the study. The results of the study were discussed here in the context of the specific objectives.

1. Analyze the existing system of managing building collapse risks.

From Table 4.26, the study found out that existing system of managing building collapse risks is poor and not credible, and cannot adequately be used to address the risks associated with building collapse. This finding is in agreement with the studies of Oruonye et al (2016), Adefisoye (2015), Essoh ,Abutu (2018) and Adio-Moses and Taiwo (2019) that identified several factors undermining the effectiveness of the existing system in the management of disasters in Nigeria.

2. **Determine the impact of building collapse risks on building development and Nigerian economy**

The impacts of building collapse risks on the building development in Nigeria were critically analyzed and ranked. The results of the analysis show that the most sub-risk factors the prominently impact on the building development in Nigeria are:- loss of lives, loss of property, structural damage , environmental damage, professional marketability to Foreign firms/clients and apportioning of blames and arbitrary words of mouth among the stakeholders (see tables 4.10 – 4.15). From the analysis on table 4.15, the building development in Nigeria is negatively impeded by the following physical risks: structural damage, loss of strength of the building, replacement/repair of the structures, damage of contents and damage of materials beyond re-use.

The law/legal risks impact on the building development in Nigeria as shown on table 4.15 in the following ways: it results to apportioning blames and arbitrary words of mouth among the stakeholders, legal tussle among stakeholders, among others. This discourages patronage of the building industry professionals and thereby leading to loss of job and income

Tables 4.18 – 4.21 show the analysis of building collapse risks and how they impact on the Nigerian economy.. These building collapse risks according to their classification in this study are: economic/financial risks, socio-political risks, human related risks, environmental risks, physical risks and law/legal risks.

From the analysis on table 4.18, the economic/financial risks impact negatively on the Nigerian economy. This is shown by the mean values of the sub-factors and the risks that severely impact on the Nigerian economy according to their severity are: loss of property, cost of rebuilding/repair, treatment of the injured, loss of materials and waste of resources, time and labour

The socio-political risks that impacts on the Nigerian economy according to their degree of impact are: professionals' marketability to foreign firms/client is devalued, loss of reputation and integrity of the contractors, loss of trust, portrays the Nigerian building industry as being corrupt and discourages investment in the property development (table 4.19).

The analysis on table 4.20 reveals the human related risks that impact negatively on the Nigerian economy. These risks include: loss of lives, injuries, permanent disability of the victims and psychological damage. The impact of these risks results to scarcity of property, labour and discourages investment on the housing sector.

The analysis on table 4.21 shows that environmental risks impacts moderately on the building development in Nigeria. The sub-risk factors with moderate impact include: environmental damage and degrading of the environment, among others.

The analysis on table 4.17 reveals that building collapse risks impacts negatively on the Nigerian economy. The principal components analysis (PCA) performed shows that economic/financial risks has the highest impact, followed by socio-political risks, human related risks, physical risks, environmental risks and lastly law/legal risks. Hypothesis I also agree with the results of the analysis and conclude that there is significance impact of building collapse risks on the Nigerian economy.

3. **Examine the challenges faced by the management agencies in the management of building collapse risks in Nigeria.**

Table 4.22 reveals that the emergency management agencies face numerous challenges which affect their effective performance in the management of building collapse risks in Nigeria. These challenges include: lack of adequate funding, lack of proper coordination and collaboration among management agencies, among others. Also hypothesis III strengthened

the result of the analysis agreeing that the challenges faced by the emergency management agencies have significance effect on the management of building collapse risks in Nigeria. This finding agrees with Adefisoye (2015) and Essoh and Abutu (2018) who in their study stated that poor funding, coordination and collaboration among emergencies management agencies have been the major cogs in the wheel of progress of the agencies and have hindered their performance.

4. **Establish the critical success factors for effective management of building collapse in Nigeria**

The analysis on table 4.23 and the Principal Component Analysis (PCA) carried out showed that the most critical factors for effective management of building collapse risks in Nigeria are: adequate funding and monitoring of the activities of all emergency management agencies, establishment of functional disaster management institutions at all levels of governance, develop the capacity of relevant institutions and stakeholders, monitor the state of preparedness, establishment disaster management volunteers in rural and urban areas and establishment of collaborative network of all the stakeholders.

5. **Develop and validate a framework for effective management of building collapse in Nigeria**

A framework for effective management of building collapse in Nigeria was proposed and validated. From table 4.27, the analysis of the effectiveness of the framework shows that the framework is effective and can be applied with confidence in addressing building collapse risks in Nigeria.

A comparison was made between the existing system and the developed framework. The result therefore, indicated that the developed model is more effective in managing the building collapse risks. The result is substantiated by the differences in the average mean scores of the effectiveness of the developed model (3.13) of managing building collapse risks and the existing system (1.97) based on some selected criteria and expert assessment (Tables 4.26 & 4.27, Section 4.1.13). This is in agreement with hypothesis IV that shows there is significant difference between the developed model of managing building collapse risks and the existing system

It was therefore concluded that the developed framework would be useful in addressing the issues of building collapse risks in Nigeria if applied.

The benefits/prospects include: reduction in loss of lives and properties, increase in supply of real estate properties, restoration of confidence on construction professionals, realization of investment objectives and increase in the socio-economic development of the nation.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

From the results of the analyses done, the following conclusions were made. Building collapse risks have significant impact on building development in Nigeria, and the Nigerian economy. It was also discovered that the building collapse risk factors that impact majorly on building development in Nigeria and the Nigerian economy are economic/financial, socio-political and human related risks.

The processes employed in the management of building collapse risks are not effectively applied in Nigeria. This continues to lead to loss of numerous lives and properties which negate the United Nations Millennium Development Goals (MDGs) aimed at reducing the mortality rate and improving safety and life expectancy of the world population.

The emergency management agencies face numerous challenges which affect their performance in handling building collapse in Nigeria and these include lack of adequate funding, coordination and collaboration among the management agencies, among others.

There is the need to checkmate the factors that affect the current management of building collapse risks in Nigeria, so as to reduce the numerous lives and properties lost through building collapse, boast the supply of real properties and increase the socio-economic development of the nation.

5.2 Recommendations

Based on the findings of the study, the following recommendations were made:

1. There should be adequate funding by government of all emergency management agencies at all levels of governance to improve their performance.
2. The activities of all the emergency management agencies should be closely monitored to ensure that the processes involved in addressing building collapse risks are effectively applied.
3. The government should address the challenges faced by the management agencies which affect their effective performance in the management of building collapse risks in Nigeria
4. The government should establish disaster management volunteers in both rural and urban areas
5. The activities of NGOs engaged in the Management of disaster should be coordinated and supported by government and private organizations.
6. There should be collaborative network among all stakeholders involved in disaster management.
7. There is the need to address the factors that affect the current management of building collapse risks in Nigeria, so as to reduce the numerous lives and properties lost through building collapse

5.3 Contribution to knowledge

This work contributed to knowledge in the following ways:

1. The work identified the critical success factors for management of building collapse risks in Nigeria (see table 4.24)

2. The work identified and classified building collapse risks into major and sub- factors (see tables 2.8 & 4.4 – 4.9)

3. The work exposed the benefits/prospects of managing building collapse risks in the study area (figure 4.5)

4. A framework was developed and validated for the effective management of building collapse risks in Nigeria (see figure 4.5).

5.4 Suggested Areas for Further Studies

The following areas are suggested for further studies;

1. Analysis of the impact of Building Collapse Risks on the stakeholders in the Nigerian built environment.

2. Performance Evaluation of Disaster Management Agencies in Nigeria.

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APPENDICES

Appendix A: Introductory Letter to the Questionnaire

Federal University of Technology Owerri

Technology for Service

Department of Project Management Technology
School of Management Technology

25th September, 2019.

Dear Respondent,

I am a PhD student of Department of Project Management Technology, Federal University of Technology Owerri and carrying out a research on "Management of Building Collapse Risks in Nigeria: A Post Mortem Investigation". The research is in partial fulfillment of the requirements for the award of Doctor of Philosophy (PhD) in Project Management Technology.

Please, kindly answer the questions below in all honesty and to the best of your knowledge as this is purely for academic purposes. You are assured of utmost confidentiality in all the information provided.

Thanks for your kind cooperation.

Yours Sincerely

Obodoh Dominic A.

,

QUESTIONNAIRE

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

1. State/City: (a) Abuja (b) Owerri (c) Ibadan (d) Port Harcourt (e) Lagos.
2. Gender: Male ( ) Female ( )
3. Age: (a) Less than 30 years ( ) (b) 31 – 40 years ( ) (c) 41 – 50 years ( ) (d) 51 – 60 years ( ) (e) 61 years and above ( )
4. Profession: (a) Architect ( ) (b) Builder ( ) (c) Engineer ( ) (d) Quantity Surveyor ( ) (e) Town Planner ( ) (f) Others Specify ----------
5. Working Experience: (a) Less than 5 years ( ) (b) 5 – 10 years ( ) (c) 11 – 15 years ( ) (d) 16 – 20 years ( ) (e) 21 years and above ( )
6. Educational Qualification: (a) ND/NCE ( ) (b) B.Sc/HND ( ) (c) M.Sc ( ) (d) PhD ( ) (e) Others specify ----------
7. Professional Qualification: (a) MNIA ( ) (b) MNIOB (c) MNSE ( ) (d) ANIQS ( ) (e) MNITP ( ) (f) Others specify ----------
8. Status of Respondent: (a) Professional ( ) (b) Occupant of collapsed building ( ) (c) Staff of Emergency Management Agency ( )

SECTION B: IMPACT OF BUILDING COLLAPSE RISKS ON BUILDING DEVELOPMENT AND NIGERIAN ECONOMY

In your own opinion, state the extent of agreement on the impact of the following building collapse risks on building development and Nigerian economy. SA = Strongly agree (5), A = Agree (4), U = Undecided (3), D = Disagree (2), SD = Strongly disagree (1).

S/No	Economic/Financial Risks	SA	A	U	D	SD
1.	Loss of property					
2	Loss of annual income/capital investment					
3	Loss of materials					
4	Bankruptcy of investor or developer					
5	Decrease in the contributions of real estate sector to the nation's GDP					
6	Loss of life investment					
7	Increase in the cost of maintenance					
8	Shortage in the supply of real estate facilities					

9	Clean up costs					
10	Rescue costs					
11	Cost of investigation/compensation					
12	Treatment of injured people					
13	Cost of rebuilding/repair					
14	Cost of loss of functionality					
15	Cost of replacement/repair of its contents					
16	Cost of temporary relocation					
17	Regional economic effects					
18	Waste of resources, time and labour					
19	Cost of legal dispute					
	Socio-Political Risks					
1	Loss of reputations and integrity of the contractors					
2	Psychological trauma and shocks					
3	Loss of new commission and contracts					
4	Withdrawal of practicing licenses					
5	Loss of trust					
6	Discourages investment in property development					
7	Loss of jobs					
8	Scarcity of property					
9	Loss of prestige of the owner					
10	Shortage of manpower					
11	De-marketing the values of industry professionals					
12	Portrays the Nigeria building industry as being corrupt					

13	Professionals' marketability to Foreign firms					
	/clients has been devalued					
	Human Related Risks					
1	Loss of lives					
2	Injuries					
3	Disruption of educational activities					
4	Loss of the contribution from the victims towards the socio-economic growth of the nation					
5	Increase in death rate against the United Nations Millennium Development Goals (MDGs)					
6	Leads the victims to permanent disability					
7	Psychological damage (fear, helplessness, distress, depression and suicides)					
8	Disruption of economic activities					
	Environmental Risks					
1	Provides hideouts for robbers and hoodlums					
2	Place of abode for dangerous animals like snakes					
3	Environmental damage					
4	Loss of functionality in the neighborhoods					
5	CO_2 Emissions/Pollution					
6	Reduction in the energy use					
7	Increase in toxic emission					
8	Environmental studies/repair					
9	Loss of building aesthetic values					

10	Degrading of the environment					
	Physical Risks					
1	Structural damage					
2	Damage to contents					
3	Loss of functionality					
4	Replacement/repair of structure					
5	Replacement/repair of contents					
6	Temporary relocation					
7	Loss of strength of the building					
8	Shortage of manpower					
9	Increment of sick citizens					
10	Street blockage					
11	Evacuation difficulty					
12	Travel distance increment					
13	Damage of materials beyond re-use					
14	Loss of fauna and flora					
	Law/Legal Risks					
1	Exasperation of crises among stakeholders					
2	Legal tussle among stakeholders					
3	Arbitration/Mediation to resolve crises arising from building collapse					
4	Conflicts resolution					
5	Apportioning blames and arbitrary words of mouth among the stakeholders					

SECTION C: PROCESSES OF MANAGING BUILDING COLLAPSE RISKS IN NIGERIA

9. State the level of effective application of the following management strategies to reduce or eliminate the building collapse risks in the study area.

VE = Very Effective (5), E = Effective (4), U = Undecided (3), I = Ineffective (2), VI = Very Ineffective (1)

S/No	Strategies	VE	E	U	I	VI
1	Establishment of institutions and agencies to take care of emergency related issues/events					
2	Evacuation and emergency services					
3	Provision of temporary accommodation and feeding					
4	Reconstruction of damaged areas					
5	Property insurance					
6	Life insurance					
7	Reduce or avoid losses from building collapse					
8	Prompt assistance to the victims					
9	Rapid and effective recovery of affected victims					
10	Maintenance of law and order					
12	Prevention of trespassing, looting, etc					
13	Recovery of dead bodies and their disposal					
14	Medicare for the injured					
15	Supply of food and water					
16	Prompt availability of relevant information to the right people					
17	Establishment of Emergency Management Volunteers to compliment the organized structures					

18	Establishment of Disaster Response Units (DRUs) in different military formations across the country to provide assistance to civil					
	authority during emergencies.					
19	Proper funding of disaster management structures across the country					
20	Develop capacity of relevant institutions and stakeholders for effective and efficient disaster management in Nigeria					
21	Ensure psychosocial support to affected persons					
22	Establishment of community structures (Neighbourhood Associations, Schools, Community Based Organizations (CBOs), Faith Based Organizations (FBOs), Non-Governmental Organizations (NGOs)					
23	Bring order to a chaotic situation					
24	Establishment of Community Disaster Management Teams					
25	Training of disaster management teams in areas such as: Search and rescue, first aid, trauma management, shelter restoration and livelihood resuscitation, among others.					
26	Establishment of emergency communication and information dissemination centers (call centers) across the country					
27	Recruiting team of Facilitators and Enablers for effective and efficient integration and coordination in disaster management					
28	Restoration of properties, essential services and infrastructure damaged by the building collapse					

SECTION D: CHALLENGES FACED BY THE MANAGEMENT AGENCIES IN THE MANAGEMENT OF BUILDING COLLAPSE RISKS IN NIGERIA

10. State the extent of agreement on how the following factors affect the management agencies in the building collapse risk practices in Nigeria

SA = Strongly agree (5), A = Agree (4), U = Undecided (3), D = Disagree (2), SD = Strongly disagree (1).

S/No	Response Option	SA	A	U	D	SD
1	Lack of proper coordination of disaster management activities in Nigeria					
2	Insincerity on the part of the government to provide emergency services					
3	Lack of adequate funding					
4	Poor attitudinal disposition of Nigerians towards emergency situations					
5	Perceive of disaster occurrence as "the wrath of the gods"					
6	Absence of disaster training platforms					
7	Bureaucratic bottlenecks in obtaining emergency assistance					
8	Lack of or ineffective Disaster Management Information System (DMIS)					
9	Poor Urban Planning					
10	Inadequate Policy Framework					
11	Limited insurance covers					
12	Inadequate support facilities and services					
13	Weak co-operative efforts from occupants and neighbourhood inhabitants					
14	Inappropriate design and use of buildings					
15	Negligence on the part of emergency management agencies.					

SECTION E: CRITICAL SUCCESS FACTORS FOR EFFECTIVE MANAGEMENT OF BUILDING COLLAPSE RISKS IN NIGERIA

11. In your own opinion, state the extent of the following critical success factors in ensuring effective management of building collapse risks in Nigeria

    VE = very effective (5), E = Effective (4), U = Undecided (3), I = Ineffective (2), VI = Very ineffective (1)

S/No	Response Option	VE	E	U	I	VI
1	Establishment of functional disaster management institutions at all levels of governance					
2	Develop the capacity of relevant institutions and stakeholders for effective and efficient management of building collapse risks					
3	Coordination of the activities of all stakeholders in disaster management					
4	Monitor the state of preparedness of all organizations and agencies which may contribute to the management of building collapse risks					
5	Educate the public on the prevention and control measures of building collapse risks					
6	Coordinate and support the activities of nongovernmental organizations engaged in the management of building collapse risks					
7	Mobilize financial and technical resources from private sector and international non-governmental organizations					
8	Establishment of disaster management volunteers in both rural and urban areas					
9	Training of emergency management personnel in different types of emergency situations					

10	Provision of relevant rescue equipment and trained					
	personnel					
11	Policy review of the emergency agencies to simplify their hitherto bureaucratic procedures of operation					
12	Adequate funding and monitoring of the activities of all emergency management agencies (NEMA, SEMA,LEMA, Fire service, Red Cross Society, NGO's, etc					
13	Creation of adequate emergency management awareness to the Nigerian populace, both rural and urban areas					
14	Prompt and appropriate assistance to victims of building collapse					
15	Establishment of collaborative network of all the stakeholders.					

SECTION F: FACTORS AFFECTING THE EXISTING SYSTEM OF MANAGING BUILDING COLLAPSE RISKS IN NIGERIA

1. State the extent of agreement on how the following factors undermine the existing system of managing building collapse risk in Nigeria

   SA = Strongly agree (5), A = Agree (4), U = Undecided (3), D = Disagree (2), SD = Strongly disagree (1).

S/No	Response Option	SA	A	U	D	SD
1	Lack of proper coordination of disaster management activities in Nigeria					
2	Insincerity on the part of the government to provide emergency services					
3	Lack of adequate funding					
4	Poor attitudinal disposition of Nigerians towards emergency situations					
5	Perceive of disaster occurrence as "the wrath of the gods"					
6	Absence of disaster training platforms					
7	Bureaucratic bottlenecks in obtaining emergency assistance					
8	Lack of or ineffective Disaster Management Information System (DMIS)					

9	Poor Urban Planning					
10	Inadequate Policy Framework					
11 12 13	Limited insurance covers Inadequate support facilities and services Weak co-operative efforts					
14	Inappropriate design and use of buildings					
15	Negligence					

Appendix B – Some reported collapsed buildings in Nigeria (2009 – 2020)

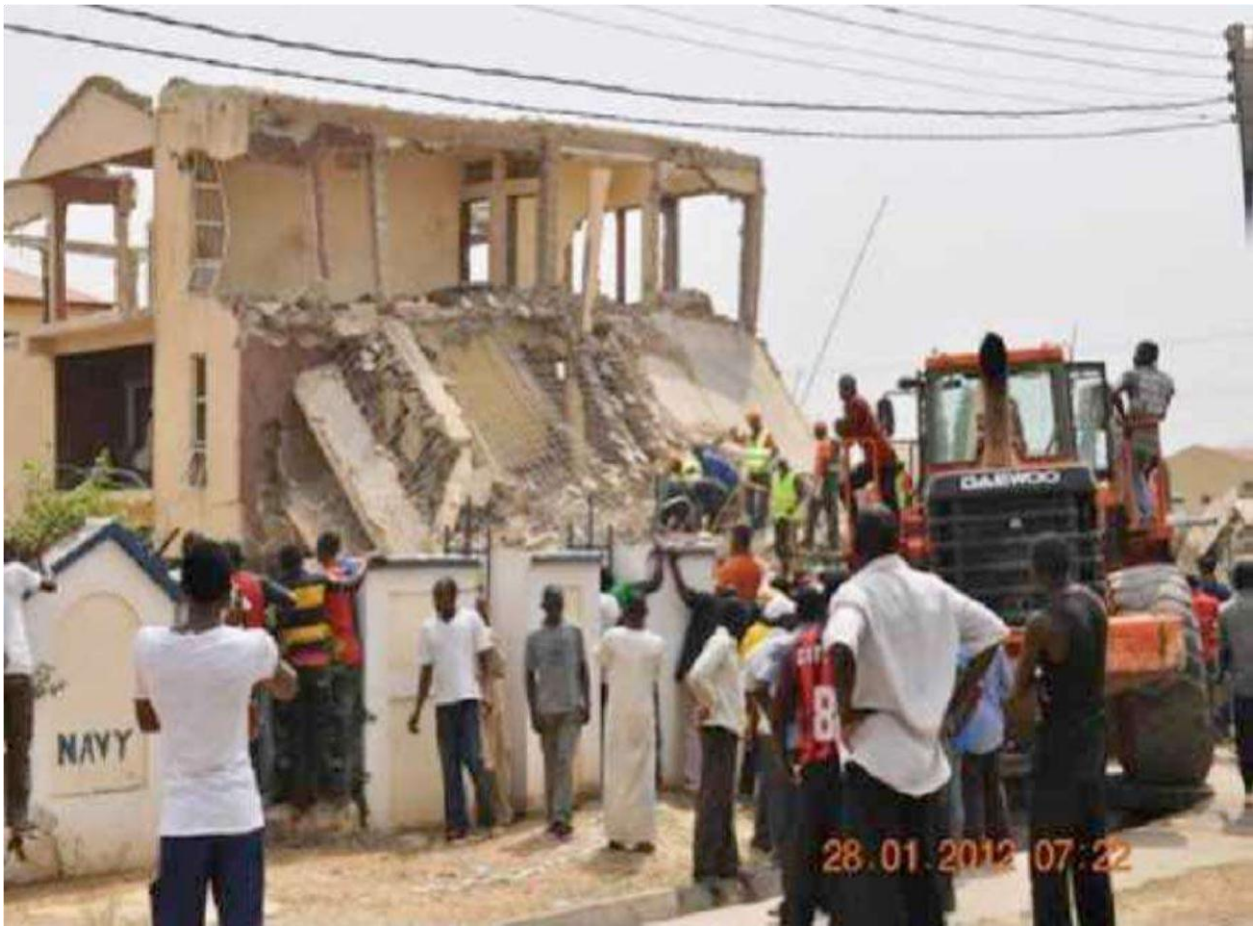


Plate 1: Collapse of Two storey Naval building in Abuja (Source: Ebihikhalu and Dawan, 2014

Plate 2A: Six Storey building at 11 Aderibigbe Street, Maryland Lagos (Source: NBRRI)

Plate2B: Six Storey building at 11 Aderibigbe Street, Maryland Lagos (Source: NBRRI)

Plate 3: A cross section of a collapsed building in Lekki Area of Lagos.
Source: www.google.com.ng

Plate 4: Catastrophic collapse at Ikole Street Abuja of 11th August, 2010 (Courtesy of Nation online

Plate 5: Collapse of a 2 – Two Storey Building Bode Area of Ibadan
Source: www.google.com.ng

Plate 6: 7 – Storey Building collapse in Port Harcourt.
Source: www.google.com.ng

Plate 7: 3 – Storey Building that collapsed in Umuguma, Owerri West LGA, 2018.
Source: www.google.com.ng

Plate 8: Collapse of a Two Storey Building around Fire Service Area/Mbaise Road, Owerri, 2017
Source: www.google.com.ng

Plate 9: 8 – Storey Building under construction that collapsed at Yardua Drive Owerri (April 30, 2020). Source; www.google.com.ng

Appendix C

Descriptive Statistics

	N	Mean	Std. Deviation	Minimum	Maximum
Building collapse risks	69	681.5507	324.49955	155.00	1612.00

One-Sample Kolmogorov-Smirnov Test

		Building collapse risk
N		69
Normal Parameters[a,,b]	Mean	681.5507
	Std. Deviation	324.49955
Most Extreme Differences	Absolute	.119
	Positive	.119
	Negative	-.067
Kolmogorov-Smirnov Z		.987
Asymp. Sig. (2-tailed)		.0285

a. Test distribution is Normal.

b. Calculated from data.

Appendix D

Descriptives

variable1

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	Between-Component Variance
						Lower Bound	Upper Bound			
Economic/Financial Risk		19	765.2105	330.67516	75.86209	605.8302	924.5909	403.00	1612.00	
Socio-political Risk		13	755.9231	359.41700	99.68434	538.7296	973.1166	217.00	1488.00	
Human Related Risks		8	713.0000	436.83766	154.44544	347.7946	1078.2054	155.00	1395.00	
Environmental Risks		10	502.2000	208.10831	65.80962	353.3283	651.0717	186.00	868.00	
Physical Rick		14	577.9286	301.93210	80.69475	403.5982	752.2590	155.00	1240.00	
Legal Risk		5	768.8000	45.98043	20.56307	711.7078	825.8922	713.00	837.00	
Total		69	681.5507	324.49955	39.06515	603.5974	759.5040	155.00	1612.00	
Model	Fixed Effects			319.66112	38.48268	604.6492	758.4522			
	Random Effects				47.02839	560.6604	802.4410			3802.31119

Test of Homogeneity of Variances

variable1

Levene Statistic	df1	df2	Sig.
2.324	5	63	.053

ANOVA

variable1

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	722853.663	5	144570.733	1.415	.031
Within Groups	6437543.410	63	102183.229		
Total	7160397.072	68			

Robust Tests of Equality of Means

variable1

	Statistic[a]	df1	df2	Sig.
Brown-Forsythe	1.556	5	36.622	.197

a. Asymptotically F distributed.

Multiple Comparisons

Dependent Variable:variable1

	(I) factor1	(J) factor1	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
LSD	Economic/Financial Risk	Socio-political Risk	9.28745	115.05787	.936	-220.6374	239.2123
		Human Related Risks	52.21053	134.72553	.700	-217.0170	321.4380
		Environmental Risks	263.01053*	124.88550	.039	13.4468	512.5743
		Physical Rick	187.28195	112.59159	.101	-37.7144	412.2783
		Legal Risk	-3.58947	160.66957	.982	-324.6620	317.4830
	Socio-political Risk	Economic/Financial Risk	-9.28745	115.05787	.936	-239.2123	220.6374
		Human Related Risks	42.92308	143.64244	.766	-244.1234	329.9696
		Environmental Risks	253.72308	134.45658	.064	-14.9670	522.4131
		Physical Rick	177.99451	123.12210	.153	-68.0454	424.0344
		Legal Risk	-12.87692	168.21681	.939	-349.0314	323.2775
	Human Related Risks	Economic/Financial Risk	-52.21053	134.72553	.700	-321.4380	217.0170
		Socio-political Risk	-42.92308	143.64244	.766	-329.9696	244.1234
		Environmental Risks	210.80000	151.62858	.169	-92.2055	513.8055
		Physical Rick	135.07143	141.67465	.344	-148.0428	418.1856
		Legal Risk	-55.80000	182.23487	.760	-419.9673	308.3673
	Environmental Risks	Economic/Financial Risk	-263.01053*	124.88550	.039	-512.5743	-13.4468
		Socio-political Risk	-253.72308	134.45658	.064	-522.4131	14.9670
		Human Related Risks	-210.80000	151.62858	.169	-513.8055	92.2055
		Physical Rick	-75.72857	132.35228	.569	-340.2135	188.7563
		Legal Risk	-266.60000	175.08560	.133	-616.4807	83.2807

Physical Rick	Economic/Financial Risk	-187.28195	112.59159	.101	-412.2783	37.7144
	Socio-political Risk	-177.99451	123.12210	.153	-424.0344	68.0454
	Human Related Risks	-135.07143	141.67465	.344	-418.1856	148.0428
	Environmental Risks	75.72857	132.35228	.569	-188.7563	340.2135
	Legal Risk	-190.87143	166.53963	.256	-523.6743	141.9315
Legal Risk	Economic/Financial Risk	3.58947	160.66957	.982	-317.4830	324.6620
	Socio-political Risk	12.87692	168.21681	.939	-323.2775	349.0314
	Human Related Risks	55.80000	182.23487	.760	-308.3673	419.9673
	Environmental Risks	266.60000	175.08560	.133	-83.2807	616.4807
	Physical Rick	190.87143	166.53963	.256	-141.9315	523.6743

*. The mean difference is significant at the 0.05 level.

Variables

			Subset for alpha = 0.05
	Factor	N	1
Tukey B[a,,b]	Environmental Risks	10	502.2000
	Physical Rick	14	577.9286
	Human Related Risks	8	713.0000
	Socio-political Risk	13	755.9231
	Economic/Financial Risk	19	765.2105
	Legal Risk	5	768.8000
Waller-Duncan[a,,b,,c,,d]	Environmental Risks	10	
	Physical Rick	14	
	Human Related Risks	8	
	Socio-political Risk	13	

Economic/Financial Risk	19	
Legal Risk	5	

Means for groups in homogeneous subsets are displayed.

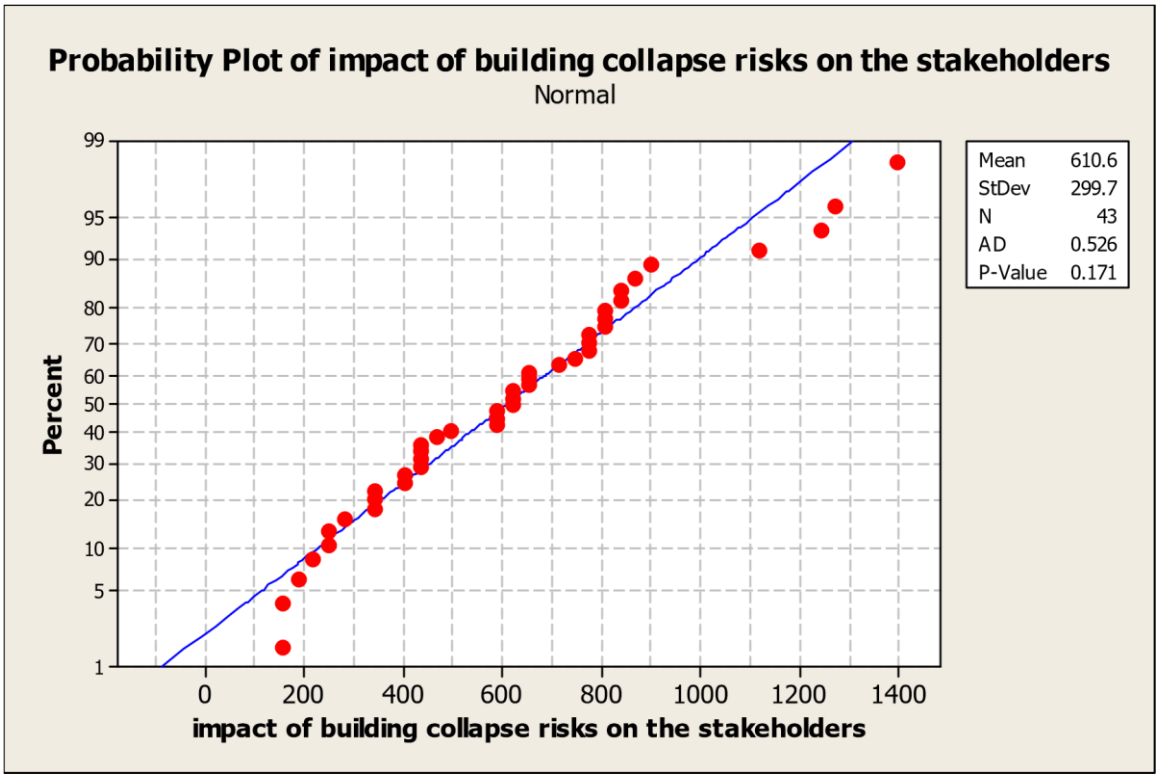
a. Uses Harmonic Mean Sample Size = 9.585.

b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

c. Type 1/Type 2 Error Seriousness Ratio = 100.

d. There are no homogeneous subsets for alpha = 0.05.

Appendix E:



From the analysis above, it shows that the data for identifying impact of building collapse risk on stakeholders are normally distributed since the probability value (0.171) is greater than the alpha value (0.05)

Appendix F : Factor Analysis

Factor Analysis: strategies

Principal Component Factor Analysis of the Correlation Matrix

Unrotated Factor Loadings and Communalities

Variable Factor1 Factor2 Communality sta -
0.767 -0.641 1.000 C4 0.767 -0.641
1.000
Variance 1.1781 0.8219 2.0000
% Var 0.589 0.411 1.000

Factor Score Coefficients

Variable Factor1 Factor2 sta
-0.651 -0.780 C4 0.651 -
0.780
Factor Score Coefficients

Variable Factor1 Factor2 sta
-0.651 -0.780 C4 0.651 -
0.780

Eigenvalue 1.1781 0.8219
Proportion 0.589 0.411
Cumulative 0.589 1.000

p-value 0.0001

Appendix G: One way ANOVA

One-way ANOVA: sta, C3

Source DF SS MS F P
Factor 1 0 0 0.00 1.000
Error 54 3375876 62516 Total 55
3375876

S = 250.0 R-Sq = 0.00% R-Sq(adj) = 0.00%

Individual 95% CIs For Mean Based on
Pooled StDev
Level N Mean StDev ---------+---------+---------+---------+ sta 28 800.8 250.0 (------
------------*-----------------) C3 28 800.8 250.0 (-----------------*-----------------)
---------+---------+---------+---------+
750 800 850 900

Pooled StDev = 250.0

Appendix H:

Some reported cases of Building collapse in Nigeria from 2009 – 2020

Table 2.3: Some reported cases of Building collapse in Nigeria from 2009 – 2020.

S/No	Location	Building Type	Date	Cause of collapse	Casualties
1	Ogbomoso Oyo State	6-Storey LAUTECH Teaching Hospital Complex	February, 2009	Use of substandard materials Poor workmanship/ Supervision	5 died
2	Aghaji Crescent, GRA Enugu	A fence wall	August, 2009	No proper drainage	1 died
3	Oke Padre St Ita Morin, Abeokuta	Uncompleted Building	October, 2009	Substandard materials, Hasty construction	3 died, 11 injured
4	Isopakodowo St., Cairo Oshodi, Lagos	Building under construction	April, 2010	Use of substandard materials	4 died, 12 injured
5	Adenike St., Off New market, Oniru Estate, Lagos	Uncompleted storey building	June, 2010	Substandard materials, Non-compliance with approved building plans and weak structure	1 died, 2 injured
6	Ikole St. Area 11, Abuja	Uncompleted 3-Storey Building	August, 2010	Undisclosed	5 died, 40 trapped
7	24 Alli Street V.I. Lagos	4-Storey Building	September,2010	Structural defects/overloading	3 died
8	Maraba, Abuja	2-Storey Zenith Bank Building	2011	N/A	N/A
9	Mpape, Abuja	4-Storey Hospital Building	2011	N/A	N/A
10	11 Aderibigbe St, Maryland Lagos	5-Storey Office Complex with a Pent house	2011	Structural failure, Gross serviceability limit violation	Nil

11	Adenubi Close, Ikeja Lagos	5-Storey Hotel Building	2011	N/A	N/A
12	16 Nnobi Str. Uwani Enugu	3-Storey Block of Flats	2012	Structural defects	N/A
13	Awka, Anambra State	One storey residential building	2012	Defective materials	N/A
14	Owerri, Imo State	3-Storey Block of Flats in a water logged area of Owerri	2012	Flooding	N/A
15	Agbama Estate, Umuahia, Abia State	Four storey Block of Flats at Agbama Estate, Umuahia	2012	Non-adherence to building Regulation that permits only 2 floors in the area	Undisclosed number of squatters Perished
16	Abanye Street Onitsha, Anambra State	4-Storey commercial building collapsed during a downpour.	2013	Heavy Rainfall/flooding	N/A
17	Bukuru, Jos South LGA	2-Storey School Building	September, 2013	Structural failure, Violation of Original approved plan	10 died
18	Oloto Street, Ebute Meta Lagos	3-Storey building	July, 2013	Dilapidated structure	7 died
19	House No.12 Hadeja Road Kaduna	Old 3-Storey Building	July, 2013	Old and dilapidated	3 died
20	Ikotun Egbe, Lagos	6-Storey Synagogue Guest House Building	September 2014	Structural failure	116 died 100 injured
21	Maryland, Enugu	3-Storey Building Under construction	April, 2015	Unknown	Nil
22	Dolphin Estate, Ikoyi Lagos	Residential building of Senior Politician	July, 2015	Gas Explosion	3 injured

23	Ebute Meta Lagos	3-Storey Building	July, 2015	Weak Structure	Nil
24	Oduma, Aninri LGA, Enugu State	St Anthony Catholic Church, Oduma	2015	Unknown	5 died
25	Lekki Gardens Lekki Phase 1, Lagos State	5-Storey building Under construction	March, 2016	Violation of approved number of floors	34 died
26	Itoku Market, Abeokuta, Ogun State	4-Storey Shopping Plaza	May, 2016	Under investigation	1 died
27	444 Crescent, Citec Villas, Gwarimpa, Abuja	Six Storey Hotel Building	August 26, 2016	Poor quality materials	Five trapped
28	Uyo, Akwa Ibom State	Reigners Bible Church, Uyo	December, 2016	Poor materials	60 died, Many injure
29	Nkpokiti Estate, Enugu	2-Storey building	March 24, 2017	Not disclosed	2 site workers injured
30	Richard Abimbola St. Ilasa, Lagos	3-Storey Building	May 29, 2017	Unknown	N/A
31	3 Massey St. Lagos Island	4-Storey Building	July 25, 2017	Not disclosed	6 died
32	Apo Mechanic Village Abuja	A storey building	July, 2017	Not Known	4 trapped
33	Hospital Junction, Umuguma, Owerri	3-Storey building Hotel Extension	July 7, 2017	Unknown	Unknown
34	Ulakwo Junction, Owerri North LGA, Imo State	Four & three Storey buildings under construction	July, 2017	Not ascertained	Unknown

35	Oforola, Owerri West LGA, Imo State	A storey building	July 8, 2017	Unknown	3 died
36	Fire Service/ Mbaise Road, Owerri	2- Storey Building	August 13, 2017	Unknown	4 died
37	9 Egbu Road, Owerri	3-Storey building	August 13, 2017	Unknown	3 died. 6 injured
38	31 Ilufe Street Ojo Alaba, Lagos	A residential building	August 28, 2017	Unknown	Nil
39	Owelle Aja Layout, Obosi, Anambra State	4-Storey building	July 17, 2018	Substandard Materials, Under the rain and sun for many years, originally had foundation for two floors and later two extra floors added.	Nil
40	Jabi, FCT,	4- Storey	August 16,	Substandard materials	2 died and
	Abuja	building	2018		many trapped in the rubbles
41	Ifite Awka, Anambra State	3 - Storey Building	October 2018	Substandard material	Nil
42	Okpuno, Otolo in Nnewi, Anambra State	3 – Storey Building	October 18, 2018	Substandard materials	Nil
43	Woji Road, GRA Phase 2, Port Harcourt, Rivers State	7 – Storey Building	November 23, 2018		5 died and more still trapped inside
44	Lagos Island	3-storey building	February 3, 2019	Not reported	2 died
45	Ita Faaji Area of Lagos State	A three-storey building	March 13, 2019	The change of use of the building from the intended purpose.	20 died

46	Yardua Drive Owerri, Imo State	8 – Storey Building under construction	April 30, 2020	Substandard materials	4 deaths and 7 injuries
47	Obale nde Area, Lagos Island	Multi-Storey building under construction	October 12, 2020	Not reported	8 reported dead
48	20 Freeman Street, Lagos Island	3 – Storey building	July 11, 2020	Not reported	3 dead
49	Dawaki Modern Market, Galadima Area, FCT Abuja	2 – Storey building	25 July, 2020	Not reported	One person seriously injured
50	Agugu Area, Ibadan, Oyo State capital	One storey building	27 April, 2020	Not reported	1 dead

Source: (Ayedun et al 2012, Windapo and Rotimi 2012, Oloke et al 2017 & News 2018, 2019 & 2020. 98

Appendix I

Introductory Letter to the Questionnaire (Validation of the Framework)

Federal University of Technology Owerri

Technology for Service

Department of Project Manage ment Technology
School of Management Technology

13th December, 2019.

Dear Respondent,

I am a PhD student of Department of Project Management Technology, Federal University of Technology Owerri and carrying out a research on “Management of Building Collapse

Risks in Nigeria: A Post Mortem Investigation". The research is in partial fulfillment of the requirements for the award of Doctor of Philosophy (PhD) in Project Management Technology.

A framework has been developed for the study as shown below and the attached questionnaire is for the purpose of validating the framework.

Kindly answer the questions below in all honesty and to the best of your knowledge. You are assured of utmost confidentiality in all the information provided.

Thanks for your kind assistance.

Yours Sincerely

Obodoh Dominic A.

,

QUESTIONNAIRE FOR VALIDATION OF THE DEVELOPED FRAMEWORK

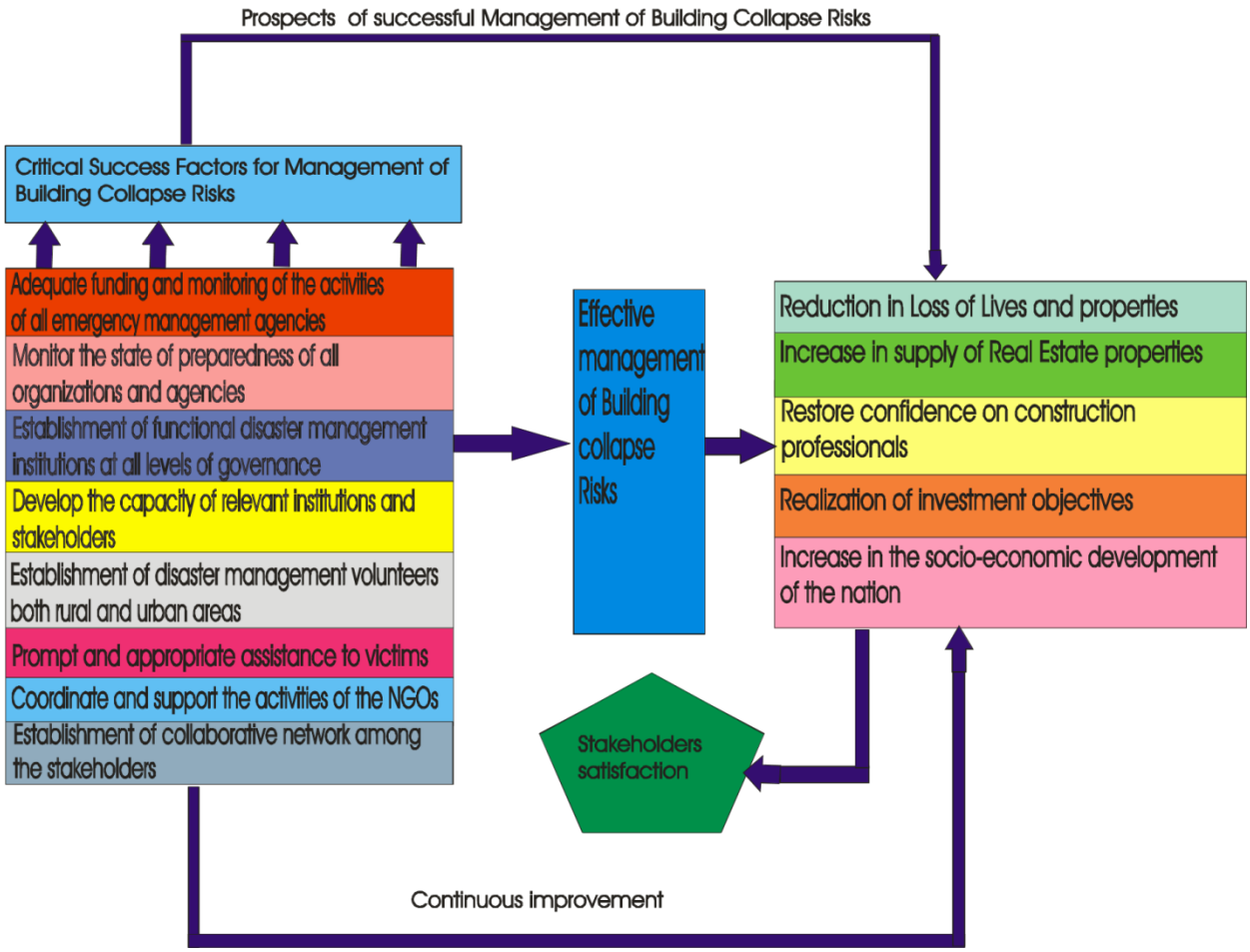
SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF THE RESPONDENTS

1. State/City: (a) Abuja ( ) (b) Owerri ( ) (c) Ibadan ( ) (d) Port Harcourt ( ) (e) Lagos ( )
2. Gender: Male ( ) Female ( )
3. Age: (a) Less than 30 years ( ) (b) 31 – 40 years ( ) (c) 41 – 50 years ( ) (d) 51 – 60 years ( ) (e) 61 years and above ( )
4. Profession: (a) Architect ( ) (b) Builder ( ) (c) Engineer ( ) (d) Quantity Surveyor ( ) (e) Town Planner ( ) (f) Project Manager ( )
5. Working Experience: (a) Less than 5 years ( ) (b) 5 – 10 years ( ) (c) 11 – 15 years ( ) (d) 16 – 20 years ( ) (e) 21 years and above ( )
6. Educational Qualification: (a) ND/NCE ( ) (b) B.Sc/HND ( ) (c) M.Sc ( ) (d) PhD ( ) (e) Others specify ----------
7. Professional Qualification: (a) MNIA ( ) (b) MNIOB (c) MNSE ( ) (d) ANIQS ( ) (e) MNITP ( ) (f) PMI ( )

SECTION B: SUITABILITY OF THE DEVELOPED FRAMEWORK IN MANAGING BUILDING COLLAPSE RISKS

Rate the suitability of the aspects of the proposed framework below in managing building collapse risks in Nigeria under the following.

S/No	Option	(1)Poor	(2)Fair	(3)Satisfactory	(4)Good	(5)Excellent
1	Clarity of the framework					
2	Logicality of the framework					
3	Comprehensiveness of the framework					
4	Practical relevance to the concept of risk management					
5	Applicability to project management					
6	Overall contribution to success of managing building collapse risks in Nigeria.					



Developed framework for effective management of building collapse risks in Nigeria

APPENDIX j

RELIABILITY ANALYSIS FOR KEY PROFESSIONALS QUESTIONNAIRE

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.746	4

Scale: impact of BCR on building development and economy

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.815	4

Scale: Challenges by emergency agencies

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.746	4

Reliability

Scale: Overall

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.725	12

RELIABILITY OF QUESTIONNAIRE FOR STAFF OF EMERGENCY MANAGEMENT AGENCIES

Scale: Impact on development and economy

Reliability Statistics

Cronbach's Alpha	N of Items
.948	5

Scale: Success Factors

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.762	5

Scale: Overall

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.782	10

Reliability: Project managers

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.713	5

Scale: Challenges

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.852	4

Scale: Existing system

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

Reliability Statistics

Cronbach's Alpha	N of Items
.852	4

Scale: Impact of BCR on development and economy

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.750	3

Scale: Success factors

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.760	5

Scale: CHALLENGES

Case Processing Summary

		N	%
Cases	Valid	10	100.0
	Excluded[a]	0	.0
	Total	10	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.878	3

Scale: Overall

Case Processing Summary

		N	%
Cases	Valid	18	100.0
	Excluded[a]	0	.0
	Total	18	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.853	20