AN EVALUATION OF DISASTER PREPAREDNESS IN INDUSTRIAL BUILDINGS IN KANO METROPOLIS

BY

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P15EVBD8019
(Msc/ENV-DESIGN/7262/2010-2011)

DEPARTMENT OF BUILDING, FACULTY OF ENVIRONMENTAL DESIGN

AHMADU BELLO UNIVERSITY ZARIA

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A THESIS SUBMITTED TO THE SCHOOL OF POST GRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MASTERS DEGREE IN CONSTRUCTION MANAGEMENT.

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DECLARATION

I declare that the work in the thesis entitled 'An Evaluation of Disaster Preparedness Industrial Buildings of Kano Metropolis' has been performed by me in the Department of Building under the supervision of Dr.I.H.Mshelgaru and Dr.D.W. Dadu. The information derived from the literature has been duly acknowledged in the text and list of references provided. No part of this project was previously presented for another degree or diploma at any university.

Shuaibu Nuru Mamman

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Name of Student	Signature	Date

CERTIFICATION

This project thesis titled An Evaluation of Disaster Preparedness in Industrial Building of Kano Metropolis meets the regulations governing the award of the degree of Master of Science in Construction Management of the Ahmadu Bello University, and is approved for its contribution to knowledge and literary presentation.

……..... ……. ……

Signature Date

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Dean School of Postgraduate Studies Signature Date

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ABSTRACT

The frequent occurrence of disaster in industrial buildings, commercial buildings, shopping malls, and markets in Nigeria has become a serious threat to the nation's fragile economy. This research evaluates the Disaster preparedness of Industrial buildings of Kano Metropolis. It was effected by means of literature review and field survey in which perceptions of various industrial representative (Human resource Managers and Safety Officers) of the three categories (Small, Medium and Large Scale) of Industries encompassing both the indigenous and foreign industries within the area; were analyzed along with secondary data obtained from relevant institutions in Nigeria.A total of one hundred and twenty (120) questionnaires were distributed with one hundred and nine (109) returned well filled giving a percentage response of 91.0%.The result of the analysis revealed that: environmental pollution(Mean=3.99) as most common hazard in the area of study, thus endangering the lives of people within that area. Similarly the hazard with the most severe effect on lives and property arranged in their order of severity are: fire outbreak with 2.78 mean; Radiological Accidents with 2.62 mean ; and False majoure with 2.52 mean .Some of the viable strategies that can be adopted as a Disaster Response Strategy arranged in their order of efficiency include: 'Activation of Special Installation such as Mobile Hospital facilities"; Activation of Emergencies programme for transports within the industries' and 'preparation for emergency reception centers and shelters within the industrial building. Thus, the following are recommended: Industry should develop disaster preparedness plan that are more encompassing, stating and taking into cognizance the various possible hazards that it is prone to; The provision of adequate disaster evacuation facilities.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The frequent occurrence of disaster incidences in industrial buildings, commercial buildings, shopping malls, and markets in Nigeria has become a serious threat to the nation's fragile economy. Many major industrial and commercial buildings have experienced several disaster destroying lives and properties worth several billions of Naira (Oladokun, 2010). The socio-economic impacts of these accidents are aggravated by the fact that victims of such disasters, mostly large scale industry, traders are without adequate insurance cover. Disaster has continued to force many companies to close down, render many jobless, damage the environment and disrupt economic activities.

A disaster usually does not need to reach catastrophic proportions before it will present some of its highly destructive characteristic actions. The surviving casualties will have mainly serious and extensive burns, injuries requiring immediate rescue procedures that cannot always be provided by local resources. A vast proportions of industrial disasters can cause damage to the surrounding environment by the massive production of heat/destroying properties and the emanation of burn gases and fumes. Smoke and gas, because of their suffocating action and their direct action on the airways, represent other specific danger elements. The danger of smoke and gas is generally underestimated by the population (Makanjuol *et al.,* 2009).

All disasters, whether flood, earthquake, cyclone, drought or extensive fire, inevitably cause upheavals not only in the physical but also in the social and economic context where they

occur.Disaster is an event, natural or man-made, sudden or progressive, which impacts with such severity that the affected community or individual, the people concern are to respond by taking exceptional measures.when a disaster is of major proportions, as may be the case in an earthquakes or flood, an entire region or extensive national territory may be involved (Masellis *et al.*, 2014).

Meanwhile, a disaster plan, according to Lyall (1999), is a document which describes the procedures devised to prevent and prepare for disasters, and those proposed to respond to and recover from disasters when they occur. The responsibility for performing these tasks is allocated to various staff members who comprise 'the disaster team'. The plan should be comprehensive enough to consist several independent yet interrelated smaller plans, recognizing that every disaster has three phases; before, during and after.

According to Rivera (2010), disaster management assists in educating and managing various programs to assist in the prevention of disaster, prevent the loss of property and personal lives, and assist businesses, citizens, and organizations in obtaining the knowledge they need in order to insure a disaster-free industries and facility. This can encompass areas such as enforcement, education, engineering and disaster investigation.

Researching into the level and extend of disaster management preparedness in corporate property will go a long way at exposing facts and figures of the importance of safety and Risk reduction in Industries/workplace . Also, this exposition will help industries in improving the level of their disaster prevention means and safety equipment where they are

lacking and as such guide against disaster occurrence in Kano Industrial buildings and Nigerian industries at large.

1.2 Statement of Research Problem

One of the problems facing the industrial buildings in Nigeria is the occurrence of disasters incidence, this was attributed to lack of knowledge about disaster management plan and safety practices among stakeholders. Many major industrial and commercial buildings have been gutted by disaster destroying lives and properties worth several billions of naira (Oladokun, 2010).

Protecting industries from disasters has been critical and important because disasters possess risk in terms of safety to occupants, building integrity, business interruption and the health of the community (Oladokun, 2010). Consequently, reduction in the risk of disaster for industrial buildings has been a significant goal for society that ought to be achieved through a better understanding of all the factors that contribute to disaster risk

Adequate knowledge of disaster causes, prevention and suppression is very important to all building occupant, also provision of adequate disaster detection and mitigation equipments and disaster management plan are very important, (Makanjuola *et al.*, 2009). Thus, this study wish to asses the industrial disasters prospect and challenges for enhanced preparedness

1.3 Significance of the Study

This research is of importance to both the staff and Stakeholders susceptible to losses at the event of any Disaster in the industry. Thus, the content of this research work also stands to be beneficial to government agencies like; National Emergency Management Association

(NEMA) and other governmental organization in their ongoing campaign to create awareness on the need for a Healthy and Safe Working environment in Nigeria.

In like manner, factual data as a measure of avert economic losses will draw the attention of the industries on the need for disaster preparedness with, as in a similar scenario identified by EMDAT,in Flood Protection(2012) global economic losses in 2011 alone which engulfed a loss of up to total sum of US$121.6 billion.

Spadaccini (2003) highlighted that when disaster is not controlled it may result to injury and death of people who cannot escape its occurrence/eruption, outbreak, destruction of buildings and other tangible property. The building would have to be closing either temporary or permanent which tantamount to loss of income or possibly bankruptcy and destruction of irreplaceable human heritage.

The new dimension of disaster loss in global economy shows that in the time of globalization, disaster happening in one country is leading to huge loss in other countries. The damages of stock (infrastructure) are determining the flow Revenue of either neighboring or distantly located countries. For example, during the recent flood in Thailand the Federation of Thai Industries estimated that the damage of the record flooding to industry will total $6.2 billion. Disruptions were felt in Japan and to a lesser extent, in United States because the closed industrial estates host high-tech and automotive manufacturers like Western Digital, Seagate, Nissan, Toyota, Isuzu, ON Semiconductor, and TDK Magnecomp. Four automotive factories, accounting for 630,000 Toyotas and 240,000 Hondas annually, have closed. Over 300 Japanese companies were directly affected by the disaster and estimates suggest they will take months to recover (Yojana, 2012).

The intensity of the effect of disaster on any organization largely depends on the organizations prevention measures, mitigation measures, preparedness and emergency response as well as recovery measures (Ngulube, 2005). Thus, this research work, evaluates the disaster preparedness in the industries in Kano state; the level of disaster in the industries and the possibility of effective method of controlling it with the available mechanism put in place as means of providing a disaster free working environment in the industrial buildings and the establish the status of the industrial buildings to tendency and severity of disaster occurrence.

1.4 Aim and Objective of the Study

1.4.1 Aim

The aim of the research is to evaluate the disaster preparedness of the industrial buildings in Kano Metropolis with a view to enhancing their readiness to disaster occurrence.

1.4.2 Objectives of the study

i. To assess the disaster likelihood and its severity impact as well as the response mechanism and strategies in industrial buildings.
ii. To evaluate availability of evacuation facilities in the event of disaster in industrial buildings.
iii. To identify the rescue response expected from different organization at the event of disaster in industrial buildings.
iv. To assess the public education/enlightenment, training, and other community based disaster preparedness.

1.5 Scope and Limitation

The research work focused on survey of disaster management plan and evaluates disaster Preparedness in industrial building in Kano metropolis (industries in Sharada, Challawa, Bompai area and Zaria road). The study shall focus on either one among the followings, the emergency unit, first aid department, fire safety officer, or human resource manager.

The study was limited to only industries within the Kano metropolis. Similarly the accuracy of the research is limited to the information about the industries on Disasters preparedness. Also owing to the fact that the research was conducted when the insurgence activities were on the rise in the area of study, access was not granted and this hindered the use of the checklist in assessing the industrial Buildings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Definition of Disaster and History of Major Disaster Incidence

Alegbeleye (1999), define disaster as anything or event which directly or indirectly affects the normal administration and uses of an industry i.e. the disruption of services to users on either a short-time or a long-time basis. He further stated that this is different from the normal nature of events that are termed or described as disasters, Natural events like earthquakes, flood, and volcanic eruption are termed disaster because of the effects they have on human beings as well as their normal way of occurrence. An event becomes a disaster, only when man and the environment he has created or lived in, are affected; whereby the environment can be a nation, community, business organization, office, museum, or library etc. The moment these settings are disturbed and normal services are disrupted; the situation can be termed as a disaster (Kuligowski, 2009). Hence, a disaster as an unexpected consequences to the industry or materials in the custody of the building stressing that it can be a small-scale incident or a full-blown emergency; even though in both cases, the event or situation requires prompt action to limit damages. Alegbeleye (1993) also mentioned two common causes of industry disasters to include floods and fires. Anderson and McIntyre (1985) however added vandalism, theft, earthquake and the effect of light and temperature to the list of causes of disasters in industries. Ngulube (2005) noted that although humankind tend to associate the term 'disaster' with devastating floods, hurricanes, earthquakes and other catastrophes, risks and Disasters to materials, which include mould and humidity, tornadoes, forest fire, volcanic eruption etc. can occur anytime without notice.

Disaster is believed to be a sting of nature or repercussion of manmade actions, causing losses of both natural and manmade resources in affected areas. A risk analysis indicates the prone to disaster outbreak and spread of disaster and thus decide what measures must be taken to provide suitable arrangements for protecting people in the premises of disaster, and should ensure that the risk of disaster occurring is reduced to the absolute minimum as well as the risk of disaster spreading is minimized (Buchanan, 2001). Effective disaster management requires recognizing all the potential risks associated with the premises and effectively carrying out an assessment of the adequacy of the measures provided or needed to combat the risk (Abdulhamid *et al*., 2011).

Preparedness focuses on preparing equipment and procedures for use when a disaster occurs. Preparedness measures can take many forms including the construction of shelters, implementation of an emergency communication system, installation of warning devices, creation of back-up life-line services (e.g., power, water, sewage), and rehearsing evacuation plans, Erica (2010).

It is very important to provide an historical perspective on disasters in the context of this study. An industrial avenue in Alexandra including the great library at Alexandra established in the third century BC, was destroyed by fire first in 47 BC, during the time of Julius Caesar and then finally in 373 AD. (Ngulube, 2004). The 1966 Florence flood destroyed several industries with about 2 million volumes of cultural objects in the Bibliotheca Nazionale Centrale (Feather, 2001).

The Public Records Office of Ireland and some other factories were burnt down during the 1992 civil war leading to the loss of Irish Cultural Heritage from the Middle Age to 1790 (Bohem,1996). In November 1998, a tornado swept through Colombia destroying some industries in Missouri (Morris, 2000). In 1999, the invading force of Slobodan Milosevic systematically destroyed records pertaining to land, financial, citizenship and genealogical entitlements of the Albanian community in Kosovo (Ngulube, 2005). The National Library and Archives, a priceless treasure of Ottoman historical document including the Royal Archives of Iraq, were turned to ashes in 3,000 degrees of heat on 14th April, 2003 during the United State's invasion of Iraq (Buchanan, 2003). Fire caused extensive damage to records of the Secretarial Office and some nearby industries in Nairobi, Kenya, in 1939, destroying a vital portion of the central government records. Valuable records relating to one of the major cities in Africa were destroyed. The Pretoria City Council in South Africa lost a range of records dating back to the 1920s in a fire at its Munitoria building in March 1997 (Directorate, State Archives and Heraldic Services, 1998-1999) even as flash floods hit Mozambique's districts of Xai-Xai, Chokwe industrial layout and Guija Industrials Avenue during the year 2000. These were the worst floods since 1850.

The devastating fire at Norwich City industry in 1994, showed how vulnerable equipment, machineries and some other raw materials are the great lost to the country. Fire severally damaged the Cabildo industrial layout in New Orleans in 1988; the Loma Prieta earthquake damaged several San-Francisco's area museums and industries in 1989; smoke from an electrical fire covered equipment, machineries and some other raw materials throughout the Huntington Gallery in 1985 and mould threat on Mount Vernon's archival collections.

Though it has been observed that West Africa seems to be relatively free from disaster, Alegbeleye (1993) highlighted prominent disasters within the West African region to include the fire at the library of the Nigeria Institute of Policy and Strategic Studies, Kuru, Jos; the 1988 arson by students, which destroyed equipment, machineries and some other raw materials in the Nigeria Forestry Research Institute.

Mshelgaru *et al.,* (2011) in their study shows that disasters could happen anywhere and at any time, certain types of disasters are more likely to affect some building structure than others, especially those situated in highly populated urban areas. Buildings in Lagos metropolitan districts in Nigeria have had nasty experience from both natural and artificial disaster in the recent past, claiming enormous lives and properties.

Similarly, records indicate that Ghana has experienced a series of floods, earthquake, fire and arson related disasters over the years (Pepra, 1998 and Adinku, 2005). Some of which include the earthquake of 1939, which destroyed some industries in Aglion; the 1984 Agricultural Development Bank Head Office fire, which resulted in the loss of valuable equipment, machineries and some other raw materials and the fire outbreak at the Ghana Broadcasting Corporation in 1989 which destroyed the films, archives, equipment, machineries and some other raw materials. Conclusively, large or small, natural or man-made disaster or emergencies put an industries staff equipment, machineries and some other raw materials in danger (Pepra, 1998).

This phenomenon has become an issue of growing concern throughout the world. There has been a dramatic rise in the frequency and magnitude of disasters, threatening large populations living in diverse environments in recent years**.** Natural disasters had tripled since the 1960s, killing hundreds of people and destroying millions of dollars of property each year. These losses will increase as more people reside and work in areas that are subject to these disasters (Adinku, 2005).

The general increase in population in the last two decades has placed more people at risk whenever an extreme weather event occurs. Also the significant increase in human settlement particularly on floodplains over the past thirty years has increased the risk of flooding. If these trends continue, the costs associated with natural disasters will continue to increase (Adinku, 2005).

2.2 Disaster Sources

All of the people, organisms, things, activities, places and ways of working that are expected to be encountered MAY be sources of Disasters.

It follows, therefore, that unless you know exactly what you are managing, you will not know all of the possible sources of Disasters. They are often broken down into:

1 Inputs - Includes physical resources such as components and raw materials, reagents, human resources such as employees and contractors, and the information required to carry out the work required.

2 Hazard - Anything, living organism or way of working with the potential to cause harm

Table 2.1: Sources of Disasters

Disaster Source Climate	Disaster	Sample Risk Controls
Storm/Rain	Lightening	Shelter from storms, stay dry
Snow/Sleet	Hypothermia, Snow blindness	Goggles/sunglasses
Wind	Blown over, wind chill	
Mist/fog/low cloud	Getting lost	Navigational sills, equipment (compass, maps, GPS, radio beacons), detailed itinerary, plans and contact details at base, adequate rations, including emergency.
UV exposure	Sunburn	Suitable clothing, sunblock and hat
High temperatures	Heat exhaustion	Adequate supplies of water, electrolyte supplements, suitable clothing, shade
	Hyperthermia	As above, plus avoid over-exertion, certain drugs, alcohol
Low temperatures	Hypothermia/Frostbite	Cold weather gear, camping equipment, stay dry, out of wind
Terrain/Location		
Uplands	Loose/falling rocks, falls	Good footwear, hard hat, avoid climbing, unstable areas, use proper equipment and skills
	Mudslides	Avoidance
	Reduced oxygen	Acclimatisation
Lowlands (including below ground)	Soft ground, roof fall, radon, floods, oxygen deficient/poisonous atmosphere	Avoidance, knowledge of terrain, local knowledge, no lone working, gas detection, breathing apparatus
\Tropics	Heat exhaustion	Correct clothing, equipment
Marine/Coastal	Currents, riptides, abnormal waves	Knowledge of conditions, buoyancy aids
Inland waters, lagoons	Tides, flotsam and jetsam, quicksand, loose rocks, flash floods, drowing, sludge pits, underwater obstacles, unstable substrate	Knowledge of tides, local conditions, stay out of water, buoyancy aids
Woodland	Fire	No fires or smoking, tree

Disaster Source Climate	Disaster	Sample Risk Controls
		climbing gear and skills
Rocky areas	Falls, chippings, rock falls	Care with hammers and sample removal; goggles, gloves
Urban	Vehicles, assault	Road safety skills, local knowledge, escorts, care in questioning
Roads and railways	Vehicles, trains, electricity	Avoidance, permits, guide
Chemical		
Water pollution, dumps	Harmful chemicals, toxic/flammable gases, wastes	Stay out of water, test kits, correct clothing, purification methods, local knowledge, avoidance, PPE
Mechanical		
Machinery, plant, tools/equipment	Entanglement, trapping, crushing, etc, sudden failure	Guarding, training, maintenance, spares
Electrical		
Generators, equipment	Shock, fire, exposed circuits, differing safety standards	Use low voltages, correct use, guarding
Human activity		
Farming, forestry, industrial	Machinery, chemicals, vehicles, felling, static and mobile machinery, buildings, vehicles, large plant and machines at open cast sites and quarries	Avoidance, access permits, local knowledge, guides
Excavations, mines, quarries i.e. 'confined spaces'	Toxic gas, flooding, asphyxiation, explosive mixes, roof fall/collapse, hidden shafts, dead ends, failure of props/supports	Oxygen/other gas monitor, radon/radiation monitor, breathing apparatus, other PPE, local knowledge, no lone working, permits
Military	Explosion, ammunition	Do not touch explosives, detonators, fuses, suspect objects, etc.
Waste disposal	Hazardous materials	Avoid refuse tips, landfill sites

Disaster Source Climate	Disaster	Sample Risk Controls
Recreation		
Hunting/Shooting	Firearms	Avoid area, observe warning signs
Climbing	Rock-falls	Correct equipment, local knowledge
Horse riding	Collision	Training, riding helmet, correct equipment
ATVs/off-roaders	Collision	
Skiing	Avalanche, collision	Check weather forecasts, seek local advice
General		
Lone working	Isolation	Communications, always within hailing distance of others, ensure your location and movements are known
Health	Pre-existing conditions	Health declaration, special arrangements
	Food intolerance/allergy	Health declaration, special arrangements

(Source: COSHH 2002)

2.2.1 Sources of Fire Disasters

Fire and combustion have been defined in various ways. For our purposes, the most important statements in connection with combustion, as a phenomenon, are as follows:

1. Combustion represents a self-sustaining run of reactions consisting of physical and chemical transformations.
2. The materials involved enter into reaction with the oxidizing agent in their surroundings, which in most cases is with the oxygen in the air.

3. Ignition requires favorable starting conditions, which are generally a sufficient heating up of the system that covers the initial energy demand of the chain reaction of burning.
4. The resultants of the reactions are often exothermic, which means that during burning, heat is released and this phenomenon is often accompanied by visibly observable flaming (Buchanan, 2001).

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The combustion in the layer under the surface of solid combustible materials is called *smouldering*, and the burning reaction taking place on the interface of solid materials and gas is called *glowing*. Burning with flames (or *flaming*) is the process in the course of which the exothermic reaction of burning runs in the gas phase. This is typical for the combustion of both liquid and solid materials.

Combustible gases burn naturally in the gas phase. It is an important empirical statement that the mixtures of gases and air are capable of ignition in a certain range of concentration only. This is valid also for the vapours of liquids. The lower and upper flammable limits of gases and vapours depend on the temperature and pressure of the mixture, the ignition source and the concentration of the inert gases in the mixture (Buchanan, 2003).

i) Ignition Sources

The phenomena supplying heat energy may be grouped into four fundamental categories as to their origin (Sax 1979):

1. Heat energy generated during chemical reactions (heat of oxidation, heat of combustion, heat of solution, spontaneous heating, heat of decomposition, etc.)

2. Electrical heat energy (resistance heating, induction heating, heat from arcing, electric sparks, electrostatical discharges, heat generated by lightning stroke, etc.)

3. Mechanical heat energy (frictional heat, friction sparks)

4. Heat generated by nuclear decomposition.

The following discussion addresses the most frequently encountered sources of ignition.

A) Open flames

Open flames may be the simplest and most frequently used ignition source. A large number of tools in general use and various types of technological equipment operate with open flames, or enable the formation of open flames. Burners, matches, furnaces, heating equipment, flames of welding torches, broken gas and oil pipes, etc. may practically be considered potential ignition sources. Because with an open flame the primary ignition source itself represents an existing self-sustaining combustion, the ignition mechanism means in essence the spreading of burning to another system. Provided that the ignition source with open flame possesses sufficient energy for initiating ignition, burning will start (Sax 1979).

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B) Spontaneous ignition

The chemical reactions generating heat spontaneously imply the risk of ignition and burning as “internal ignition sources”. The materials inclined to spontaneous heating and spontaneous ignition may, however, become secondary ignition sources and give rise to ignition of the combustible materials in the surroundings. Farabi (2003).

Certain agricultural products, such as fibrous feedstuffs, oily seeds, germinating cereals, final products of the processing industry (dried beetroot slices, fertilizers, etc.), show an

inclination for spontaneous ignition. The spontaneous heating of these materials has a special feature: the dangerous temperature conditions of the systems are exacerbated by some exothermic biological processes that cannot be controlled easily Farabi (2003).

C) Electric ignition sources

Power machines, instruments and heating devices operated by electric energy, as well as the equipment for power transformation and lighting, typically do not present any fire Disaster to their surroundings, provided that they have been installed in compliance with the relevant regulations of safety and requirements of standards and that the associated technological instructions have been observed during their operation. Regular maintenance and periodic supervision considerably diminish the probability of fires and explosions. The most frequent causes of fires in electric devices and wiring are overloading, short circuits, electric sparks and high contact resistances, Mathew (2005).

Sparking introduces a Disaster foremost at places where, in the zone of their generation, explosive concentrations of gas, vapour or dust might arise. Consequently, equipment normally releasing sparks during operation is permitted to be set up only at places where the sparks cannot give rise to fire. On its own, the energy content of sparks is insufficient for the ignition of the materials in the environment or to initiate an explosion Farabi (2003).

D) Electrostatic sparks

Electrostatic charging is a process in the course of which any material, originally with electric neutrality (and independent of any electric circuit) becomes charged positively or negatively. This may occur in one of three ways, Don schramm and Richard Hansen (1993).

1. *charging with separation*, such that charges of subtractive polarity accumulate on two bodies simultaneously
2. *charging with passing*, such that the charges passing away leave charges of opposed polarity signs behind
3. charging by taking up, such that the body receives charges from outside.

These three ways of charging may arise from various physical processes, including separation after contact, splitting, cutting, pulverizing, moving, rubbing, flowing of powders and fluids in pipe, hitting, change of pressure, change of state, photoionization, heat ionization, electrostatical distribution or high-voltage discharge.

The development of fire or explosion risk necessitates the coincidence in space and time of two conditions: the presence of any combustible medium and the discharge with ability for ignition. This Disaster occurs mainly in the chemical industry. It may be estimated on the basis of the so-called *spark sensitivity of hazardous materials* (*minimum ignition energy*) and depends on the extent of charging.

It is an essential task to reduce these risks, namely, the large variety of consequences that extend from technological troubles to catastrophes with fatal accidents. There are two means of protecting against the consequences of electrostatic charging:

1. preventing the initiation of the charging process (it is evident, but usually very difficult to realize)

2. restricting the accumulation of charges to prevent the occurrence of dangerous discharges (or any other risk).

Lightning is an atmospherical electric phenomenon in nature and may be considered an ignition source. The static charging produced in the clouds is equalized towards the earth (lightning stroke) and is accompanied by a high-energy discharge. The combustible materials at the place of lightning stroke and its surroundings might ignite and burn off. At some strokes of lightning, very strong impulses are generated, and the energy is equalized in several steps. In other cases, long-lasting currents start to flow, sometimes reaching the order of magnitude of 10A, Mathew (2005).

E) Mechanical heat energy

Technical practice is steadily coupled with friction. During mechanical operation, frictional heat is developed, and if heat loss is restricted to such an extent that heat accumulates in the system, its temperature may increase to a value that is dangerous for the environment, and fire may occur. Friction sparks normally occur at metal technological operations because of heavy friction (grinding, chipping, cutting, hitting) or because of metal objects or tools dropping or falling on to a hard floor or during grinding operations because of metal contaminations within the material under grinding impact. The temperature of the spark generated is normally higher than the ignition temperature of the conventional combustible materials (such as for sparks from steel, 1,400-1,500 °C; sparks from copper-nickel alloys, 300-400 °C); however, the ignition ability depends on the whole heat content and the lowest

ignition energy of the material and substance to be ignited, respectively Don schramm *et al.*, (1993).

F) Hot surfaces

In practice, the surfaces of equipment and devices may warm up to a dangerous extent either normally or due to malfunction. Ovens, furnaces, drying devices, waste-gas outlets, vapour pipes, etc. often cause fires in explosive air spaces. Furthermore, their hot surfaces may ignite combustible materials coming close to them or by coming in contact. For prevention, safe distances should be observed, and regular supervision and maintenance will reduce the probability of the occurrence of dangerous overheating.

2.3 Types of Disasters

There are two types of disasters, one is caused by human action (artificial disaster) while the other natural. The former includes famine, flood, earthquake and the action of violent wind. The latter includes fire, deforestation, violence, urban flood, urban sprawl and squatter settlements(Abdulhamid Ibrahim and Ibrahim Jaro Musa, 2011).While Don schramm,*et al.*, (1993) says natural disaster includes sudden-onset natural disasters (i.e., earthquakes, floods, hurricanes) and slow-onset disasters(i.e., famine, drought).

2.3.1 Floods

Floods are among the most devastating natural Disasters in the world, claiming more lives and causing more property damage than any other natural phenomena. In Nigeria, at least 20 per cent of the population and 8 per cent of its industries are at risk from one form of

flooding or another. This includes the whole spectrum from the rich urban residents of Victoria Island, Lagos, Sharada industrial layout in Kano, Eleme industrial layout in Port Harcourt etc. to poor farmers and fishermen in Benue and Niger trough and the coastal regions of Nigeria (NEMA, 2006).

This phenomenon called flood occurs when water covers previously dry areas, i.e., when large amounts of water flow from a source such as a river or a broken pipe onto a previously dry area, or when water overflows banks or barriers **(**Flood Protection, 2012). Floods can be environmentally important to local ecosystems. For example, some river floods bring nutrients to soil such as in Egypt where the annual flooding of the Nile River carries nutrients to otherwise dry land. Floods can also have an economic and emotional impact on people, particularly if their property is directly affected. Having a better understanding of what causes flooding can help people to be better prepared and to perhaps minimize or prevent flood damage.

River and coastal flooding are the most frequently occurring natural disaster and are increasing in occurrence more rapidly than any other natural disaster. Analysis made by the World Bank shows that flooding is not only the most frequent natural disaster – it is also the disaster with the greatest economic and humanitarian impact in terms of number of people affected and in terms of economic asset exposure; that is buildings, transport infrastructure, utility infrastructure and other long-lived assets (Flood Protection, 2012).

An average of about 100 people are killed and millions of dollars worth of properties are damaged by landslide, heavy rainstorm and flooding each year. Images from weather satellites are used routinely for weather predictions. Data from remote sensing can be relayed to provide early warning of impending flood conditions. Geographic Information Systems (GIS) and remote sensing are useful for risk analysis and calculation of the various areas that are more at risk of flooding. This allows for better targeting of the people in the areas perceived being mostly in danger. A flooding contingency plan can be made based on regional and weather forecasts, geographic information systems, ground stations and satellite imaging Mathew (2005).

During flooding, timely and detailed situation reports are required by authorities to locate and identify the affected areas and to implement corresponding damage mitigations. During this period of response or relief, it is essential that information be accurate and timely in order to address emergency situations like search, rescue and relief. Space information can help to augment ground information for real-time damage assessment and extending threat to life and property. Space imagery integrated with GIS can also help in preparing flood recovery plans. Information collected on the mitigation, preparedness, response and recovery phases can be integrated into master flood prevention projects (Oladokun and Ishola, 2010).

2.3.2 Water

Water Disasters can originate from either external or internal sources. External sources include storms that could cause water leaks in the building or localized external flooding that seeps into the building. Storms could also cause structural damage to the building that could

provide a point of entry for water. The most likely external sources of water damage from external sources are considered to be from the roof when gutters are clogged with litter debris, when structural damage has occurred or flooding in the basement area, when excessive run-off cannot be handled by the outside storm water drains Mathew (2005).This site needs to be monitored in periods of heavy rain. Internal sources of water damage include leaks or accidental discharge from internal plumbing such as from the internal sprinklers, fire hoses, burst water pipes and overflowing sinks Oladokun *et al.,* (2010)

2.3.3 Oil Spill

Oil spill disaster is caused either by tanker break up at sea; factories, industries, illegal discharged and tanker clean up. Oil spill especially in industries could also result from sabotage. Oil is both physically and chemically hazardous with disastrous consequences in marine environments that are exposed to both chronic and acute pollution (NEMA, 2006)

. The two major applications of space technology to oil pollution are:

Law enforcement surveillance of coastal and inlands waterways for violations of pollution regulation, Monitoring of accidental spills in industries to aid clean-up operations. The three aspects of oil-spills monitoring are:

Detection of oil spills. Estimation of thickness and volume of spills Identification of the type of crude oil or refined oil in a spill. Space derived information will be needed to detect location and track oil spillages so that vital information can be relayed to relief workers, clean-up agencies, factories workers and the local population (NEMA, 2006)

2.3.4 Drought

Drought is one of the most important natural disasters in Nigeria. It is often aggravated by human actions. Since drought affects very large areas for months, even years, it has a serious

impact on regional food production, often reducing life expectancy for entire populations and economic performance of large regions. During the drought of 1972-1973, about 300,000 animals representing 13 per cent of the livestock population of north-eastern Nigeria were estimated to have died. Agricultural yields dropped to between 12 per cent and 40 per cent of the annual averages. In the drought of year 1987, crop yields ranged between 56 per cent and 75 per cent of the 1986 totals (NEMA, 2006).

The consequences of environmental breakdown as a result of a prolonged drought led to massive economic losses, destruction of ecological resources, food shortages and starvation for millions of people. Information that will be needed for drought disaster includes those to be used for prediction, monitoring, early warning, impact assessment and recovery. Such information which can be provided by space technology includes:

1 Climate variability,

2 Persistent anomalous circulation patterns in the ocean and atmosphere,

3 Initial soil moisture,

4 Knowledge of stored water available for domestic stock and irrigation uses

5 Land use types,

6 Demographic and infrastructure around the impacted area,

7 Intensity and aerial extent,

8 Water management,

9 Crop management.

(Oladokun *et al.*, 2010).

2.3.5 Fire Outbreak

Fire threat tends to be accidental or seasonal. The frequent occurrence of major fire accidents in industrial buildings, commercial buildings, shopping malls, and markets in Nigeria has become a serious threat to the nation's fragile economy. Many major industrial and commercial buildings have been gutted by fire destroying lives and properties worth several billions of naira (NEMA, 2006). The socio-economic impacts of these accidents are aggravated by the fact that victims of such fire disasters, mostly large scale industry, traders and without adequate insurance cover. Fire has continued to force many companies to close down, render many jobless, damage the environment and disrupt economic activities.

Fire could originate from either external or internal sources. External sources include the risk of bush fire and lightning strikes. Internal risks of fire are ever present with our widespread reliance on the use of electrical appliances, such as desk lamps, heaters, computers, power boards and other equipment within the collection buildings. Other possible sources of fire could include chemical spills and other inflammable materials Oladokun *et al.,* (2010) and Mathew (2005).

2.3.6 Thermal Agent Disaster, Burn Disaster

In the light of the above considerations we proposed to differentiate precisely the two concepts of "thermal agent disaster" and "burn disaster".

Thermal agent disaster: a disaster causing severe losses in human lives and material goods as a result of massive heat production. This definition expresses the relationship between a generic cause of the event (massive heat production) and the consequences for human beings

and material goods. Its extent may be aggravated if appropriate rescue operations are delayed. Some decisive factors involved here are the type of causal agent (Masellis M. *et al.,* 2014).

Speed of fire disaster from onset may vary. It can be rapid under conditions of high temperatures and high wind, when major fire fronts advance very quickly.. Recovery from its effects on the environment may take several years. Satellite remote sensing makes it possible to identify the fires that are hottest. This allows the fire fighters to analyse the conditions of the area and prioritise fire-fighting efforts (NEMA, 2006)

2.3.7 Landslides

Landslides occur in areas of relatively steep topographic slopes underlain by unstable materials. Slides are often the result of high concentrations of soil moisture that lubricate the surface materials. Landslides may cause severe damage to structures and systems (building may be buried or villages swept away). Rivers may be blocked, causing flooding, crops may be affected. Sometimes, areas of crop-producing land may be lost altogether. When landslides are combined with very heavy rain and flooding, the movement of debris (e.g. remains of buildings uprooted) may cause high levels of damage and destruction (NEMA, 2006). .

Finally, any effort at managing disaster must apply prevention strategies to reduce the impacts of natural and manmade disasters. We cannot decide how many storms will strike, or how fiercely the winds will blow, or the waters will rage. But we can decide - we must

decide together - the impact they will have on our lives and on the ecosystem. This requires a collective approach by all stakeholders (NEMA, 2006) and (Oladokun and Ishola, 2010).

Landslides

The term landslide refers to the downward movement of masses of rock and soil. Lands lides are caused by one or a combination of the following factors: change in slope gradient, increasing the load the land must bear, shocks and vibrations, change in water content, ground water movement, frost action, weathering of shocks, removal or, or changing the type of vegetation covering slopes. Landslides can also be triggered by other natural Disasters such as rains, floods, earthquakes, as well as human-made causes, such as grading, terrain cutting and filling, excessive development, etc. Because the factors affecting landslides can be geophysical or human-made, they can occur in developed areas, undeveloped areas, or any area where the terrain has been altered for roads, houses, utilities, buildings, etc.(Srinivas, 2005)

2.3.8 Cyclones, Hurricanes or Typhoons.

Cyclones develop when a warm ocean gives rise to hot air, which in turn creates convectional air currents. Cyclones occur when these conventional air currents are being displaced. The term hurricane/typhoon is a regionally specific name for a “tropical cyclone”. In Asia they are called ‘typhoons’; in the Indian and Pacific Oceans they are called ‘cyclones’; and over the North Atlantic and Caribbean Basin, they are called ‘hurricanes’(Srinivas, H. 2005)

Earthquakes an earthquake is a trembling or shaking movement of the earth’s surface, resulting from plate movements along a fault-plane or as a result of volcanic activity. Earthquakes can strike suddenly, violently, and without warning at any time of the day or

night. The following terminologies are associated with earthquakes: epicentre, fault, magnitude and seismic waves. For practical purposes, earthquakes are usually defined by their magnitude (or quantitative energy released) which is measured using a logarithm scale of 1 – 10. This logarithm scale is referred to as the Richter scale. The magnitude is determined by analysing seismic data obtained from seismometers (Srinivas, 2005).

2.4 Possible Disaster from an Industry

The greatest threats to the industrial equipment, raw materials and other collections are considered to be from fire and water. Physical damage is considered to be less likely. However a worst-case scenario could involve all three Disasters occurring simultaneously. Staff should be mindful of any signs of problems arising in these areas, Mathew (2005).

Physical damage to the equipments, raw materials and other machineries could arise from damage to the building (e. g. structural failure or storm damage) resulting in damage to the equipments, raw materials and other machineries, or from unauthorized entry leading to theft or vandalism of equipments, raw materials and other machineries.

Maintenance arrangements for all large trees in proximity to the buildings minimize the chance of damage to the building from a tree falling on it during a storm. Security arrangements at both sites minimize the risk of the unauthorized access. However it should be noted that security arrangements are not fail-safe. Systems failure is always a possibility and people should be cautious of unauthorized people. There also is the potential for the security system to fail if it is impaired in some way associated with the disaster Mathew (2005).

Disasters can also be considered as industrial disaster, if their causes are rooted in the products or processes of industry. For example, the Great Chicago Fire of 1871 was made more severe due to the heavy concentration of lumber industry, wood houses, fuel and other chemicals in a small area. Some can be related to engineering disasters when shortcuts in engineering design to reduce costs of construction and fabrication leads to unexpected design failures (Maine Emergency Management Agency, 2007).

2.5 Government Regulation on Disaster

The Convention on the Transboundary Effects of Industrial Accidents is designed to protect people and the environment from industrial accidents. The Convention aims to prevent accidents from occurring, to reduce their frequency and severity, and to mitigate their effects. The Convention addresses primarily industrial accidents in one country that affect the population or the environment of another country. The Convention was drafted following the Seveso disaster and Sandoz disaster.

India decided to enact a law on disaster management to provide for a requisite institutional mechanism for drawing up and monitoring the implementation of the disaster management plans, ensuring measures by various wings of the Government for prevention and mitigation of disasters and for undertaking a holistic, coordinated and prompt response to any disaster situation. Accordingly a Bill was introduced in the Rajya Sabha on 11th May, 2005.The Disaster Management Act, 2005 lays down institutional, legal financial and coordination mechanisms at the central, state, district and local levels (Yojana, 2012)

2.6 Disaster Risk Governance

Each country has the sovereign responsibility to protect its people, infrastructure and economic and social assets from disasters. The State has the responsibility to ensure the safety and welfare of its citizens, their livelihoods and natural resource endowments Morgan and Smith (1997). The goal of disaster risk reduction programmed is to reduce disaster risks by building capacity and increasing the resilience of communities at risk, thus enhancing their security and wellbeing. This can be done through increased government commitment to Implementing disaster reduction policies and programmed. This implies a central responsibility and commitment by the State in providing a proper and effective institutional framework and capacities for disaster (USAID, 2011). Key governance issues in disaster risk reduction include roles in policy formulation operational capabilities and capacities and varied forms of relationships among actors. In general, disaster risk governance needs to be guided by the following general principles and objectives: elevating disaster risk management as a policy priority; generating political commitment which translates into promoting disaster risk management as a multi-sectoral responsibility; assigning accountability for disaster losses and impacts; allocating necessary resources for disaster risk reduction; enforcing the implementation of disaster risk management and reduction; and multi stakeholder involvement, increasing gender sensitivity, and facilitating participation by civil society and the private sector. A number of international policies and frameworks have been developed since the 1990 these include the Yokohama Strategy and Plan of Action (1990-1999), the Hyogo Framework of Action: Building the Resilience of Nations and Communities (2005-2015), the African Regional Disaster Risk Reduction Framework and its Plan of Action as well as the draft SADC Disaster Risk Reduction

Framework. The above are examples of how disaster risk reduction has become a policy priority for governments world-wide. Such policies can well be seen as the first stepping stones towards sound disaster risk governance. endowments Morgan and Smith (1997). A core function of disaster risk reduction governance is ensuring that the necessary support exists within government to drive the disaster risk reduction agenda. There is wide international consensus that government as the administrative entity must ensure that disaster risk reduction becomes a priority. This can be done by the following measures: Develop and implement Disaster risk reduction policies, laws, regulations, directives and standards; Establish adequate structures to govern disaster risk reduction such as: national (and sub-national) disaster risk management centers/offices, national multi-sectoral coordinating mechanisms (also called National Platforms),political decision-making structures (on all levels of government),civil society structures for disaster risk reduction, and engagement with the private sector Conduct nationwide disaster risk assessments; Integrate disaster risk reduction measures into development planning Encourage research, training, education and public awareness of disaster risk issues; Ensure adequate emergency and contingency measures are in place for possible disasters; and Provide adequate funding to sustain disaster risk reduction efforts (USAID, 2011).

2.7 Disaster Management

Disaster management (or emergency management) is the term used to designate the efforts of communities or businesses to plan for and coordinate all the personnel and materials required to either mitigate the effects of, or recover from, natural or man-made disasters, or acts of terrorism. Disaster management does not avert or eliminate the threats, although their study is an important part of the field. Events covered by disaster management include acts of

terrorism, industrial sabotage, fire, natural disasters (such as earthquakes, hurricanes, etc.), public disorder, industrial accidents, and communication failures (Maine Emergency Management Agency, 2007).

Disaster management can be defined as the range of activities designed to maintain control over disaster and emergency situations and to provide a framework for helping at-risk persons to avoid or recover from the impact of the disaster. Disaster management deals with situations that occur to, during, and after the disaster.

Disaster preparedness and management is the systematic observation and analysis of disasters to improve measures relating to preparedness, prevention, mitigation, emergency response and recovery (Ngulube, 2005).

Today, lack of understanding of the relevance of space acquired data to development efforts, inadequate efforts to address the information needs of various economic sectors including the analysis and application of such information and the scarcity of skilled and educated man-power are among the bottle necks that confront sustainable development efforts (Karen, 2009). People in desperate poverty often could not cope with the magnitude of disasters. Desperate actions often ended in outcomes that prevented their living through a subsequent disaster. This is the more reason why disaster must be managed by applying various options of the technology available. Satellites remote sensing is indispensable for disaster mitigation work.

The natural disaster is likely to happen anytime and cannot be prevented; but measures could be taken to eliminate or reduce the possibility regardless of the many forms that a disaster may take. The actual damage to collections is usually caused by fire or water, which fall under the categories of man-made disasters. Even when they are not the initial factors, fires and floods almost invariably occur as secondary causes of disasters in industries. Karen (2009) stated that though an emergency does not have to become a full-fledged disaster, many industrial staffs often learn the advantages of emergency preparedness through hard experience. He stressed that Disasters can often be mitigated or avoided altogether by a comprehensive, systematic, emergency-preparedness program; which provides a means for recognizing and preventing risks and for responding effectively to emergencies. Morgan and Smith (1997) noted that industry resources are very valuable either for the information they contain or for their physical beauty. The disaster problem is further emphasized by Mathew (2005) who asserted that surveys have shown that disasters in industries are almost inevitable. Ngulube (2005) stated that disaster preparedness and security are vital to the preservation and protection of the industry. According to him, disaster planning facilitates efficient and quick response to an emergency and security protects items against theft or deliberate or unintentionally damage and destruction. Lyall (1993) stated that disaster plan is a document, describing the procedures devised to prevent and prepare for disasters and those proposed to respond to and recover from disasters when they occur. England and Evans (2007) noted that disasters strike too many industries, finding them unprepared for action. Aina (2004) stated that it is necessary for the industry to have in place plans that would mitigate the effects of a disaster. For example, in case of fire disaster, there should be an abundance of fire extinguishers at appropriate places in the industry and staff should be

trained on how to handle them in putting out the fire. He stressed that it might also be necessary for an industry to insure its holdings against such risks as fire, flood and earth-quake. Beth (2008) noted that an increasing number of professionals know that small-scale emergencies could be contained if staff members are prepared to react quickly; even as damage can be limited even in the face of a large-scale disaster. He cited the example of cultural institutions in Carlson, South Carolina, which formed a consortium focusing on disaster preparedness several years before they were hit by hurricane Hugo in (1989). According to him, many of those industries sustained only minor damage because they were able to put their early warning procedure into operation. There is no doubt that disaster planning is complex and that the written plan is the result of a wide range of preliminary activities. However, the entire process is most efficient if it is formally assigned to one person, who acts as the disaster planner for the industry and is perhaps assisted by a planning team/committee. The Industry Director may play this role or delegate the responsibility, but it is important to remember that the process is supported at the organization's highest level, for it to be effective. The planner should establish a timetable for the project and define the scope and goals of the plan, which will depend largely on the risks faced by the Industry. When a member of the main industry staff encounters an emergency, the first response should always be to contact the industries security office. When an emergency occurs, the staff will either contact public safety directly or the industry or factory security office, depending on the nature of the emergency. When the industries are closed, disaster will be detected from the outside; in which case, public safety will notify appropriate industry staff, since it maintains a list of emergency contact personnel from the industries Proulx (1995).

According to Newey, Lepschi & Croft (2008) Preparedness involves:. Identification of a disaster response team; Training of an emergency action team; Identification of recovery work areas; and

Ensuring supply of equipment and materials. When appropriate, industries security staff should take steps to limit potential damage while waiting for emergency personnel (public safety or physical plant) to arrive. Such steps include making sure that patron and staffs are not in danger (Newey *et al.*, 2008).

Safety of human beings comes before protection of industry materials. Industries security staff themselves should not take unwarranted risks to save industry equipment and raw materials. Eliminating the source of the problem is also an important step to take in an emergency. Industries security staffs are trained to use fire extinguishers to put out the fire, if possible. In the event of water damage, industries' security staff will attempt to cut off the water supply to the affected area Aina (2004). The next step is to get raw materials out of danger. If the number of raw materials threatened by water is small, they can simply be moved to a dry place. For large problems, plastic sheeting can be spread over the stacks to shield them from water coming from above. No clean up or salvage work should be attempted until the situation is stable and a damage assessment has been made. It is better to be prepared in readiness for disasters that could occur in the industry. Perhaps, the greatest threats to industry equipment, raw materials, workers and other collections are considered to be from fire, wind and water (flood), as physical damages such as earthquake, hurricane and tornado are not as common as the ones above. However a worst-case scenario could involve all three Disasters occurring simultaneously when it is raining (lightening, wind and flood). It

is therefore important that industry staff should be vigilant and mindful of any signs of problems arising in these areas (Newey *et al.,* 2008)

2.8 Pre-Evacuation Theory from an Industrial Building

The pre-evacuation time period for an occupant or workers, sometimes called pre-movement time or pre-response time, is the time beginning when the occupant/worker is alerted that something may be wrong and ending when the occupant/ worker begins purposive movement within the exit stair or exit. For some emergencies, occupants/workers are instructed to relocate to another place within the building (e.g., three floors below), and the pre-evacuation time period is the time spent before purposive movement to a place of safety begins. For most occupants/workers, depending on the structure/building, the pre-evacuation period is spent on their building floor and evacuation time is spent in the means of egress (e.g., exit stair) Erica (2010).

This definition of pre-evacuation time is for this analysis only. Other research on pre-evacuation time may define the boundaries of this time period differently Erica (2010).

Whereas some RSET calculations assume a pre-evacuation time of zero for a structure/building population, human behaviour research of past emergencies shows that occupants/workers spend time, sometimes a significant amount of time, engaging in actions during the pre-evacuation period. Studies have collected data on pre-evacuation time for occupants/worker evacuating structures/buildings during emergencies and evacuation drills. Resulting from these studies are distributions of pre-evacuation time data for use in RSET calculations Erica and Bryan (2010).

2.9 Phases of Disaster Management

Disaster management consists of five phases:

1. Prevention
2. Mitigation
3. Preparedness
4. Emergency response
5. Recovery (Ngulube, 2005).

2.8.1 Prevention

It focuses on preventing the human hazard, primarily from potential natural disasters. Preventive measures are taken on both the domestic and international levels, designed to provide permanent protection from disasters. Not all disasters, particularly natural disasters, can be prevented, but the risk of loss of life and injury can be mitigated with good evacuation plans, environmental planning and design standards. In January 2005, 168 Governments adopted a 10-year global plan for natural disaster risk reduction called the Hyogo Framework

2.9.2 Mitigation

Preventive or mitigation measures take different forms for different types of disasters. In earthquake prone areas, these preventive measures might include structural changes such as the installation of an Earthquake Valve to instantly shut off the natural gas supply, seismic retrofits of property, and the securing of items inside a building. The latter may include the mounting of furniture, refrigerators, water heaters and breakables to the walls, and the addition of cabinet latches. In flood prone areas, houses can be built on poles/stilts. In areas prone to prolonged electricity black-outs installation of a generator, the construction of storm cellars and fallout shelters are further examples of personal mitigate actions (Ngulube, 2005).

2.9.3 Preparedness

Preparedness focuses on preparing equipment and procedures for use when a disaster occurs. Preparedness measures can take many forms including the construction of shelters, implementation of an emergency communication system, installation of warning devices, creation of back-up life-line services (e.g., power, water, sewage), and rehearsing evacuation plans. Planning for all different types of events and all magnitudes is of utmost importance, so that when a disaster does occur responders know exactly what their assignments Erica (2010).

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2.9.4 Response

The response phase of an emergency may commence with Search and Rescue but in all cases the focus will quickly turn to fulfilling the basic humanitarian needs of the affected population. This assistance may be provided by national or international agencies and organizations. Effective coordination of disaster assistance is often crucial, particularly when many organizations respond and local emergency management agency (LEMA) capacity has been exceeded by the demand or diminished by the disaster itself (Ngulube, 2005).

2.9.5 Recovery

The recovery phase starts after the immediate threat to human life has subsided. The immediate goal of the recovery phase is to bring the affected area back normalcy as quickly as possible. During reconstruction it is recommended to consider the location or construction material of the property (Jaffin Bob, 2008).

2.10 Principles of Disaster Management

Wayne Blanchard 2007 codified principles of disaster management they are as follows:

1 Comprehensive – consider and take into account all Disasters, all phases, all stakeholders and all impacts relevant to disasters.

2 Progressive – anticipate future disasters and take preventive and preparatory measures to build disaster-resistant and disaster-resilient communities.

3 Risk-driven – use sound risk management principles (Disaster identification, risk analysis, and impact analysis) in assigning priorities and resources.

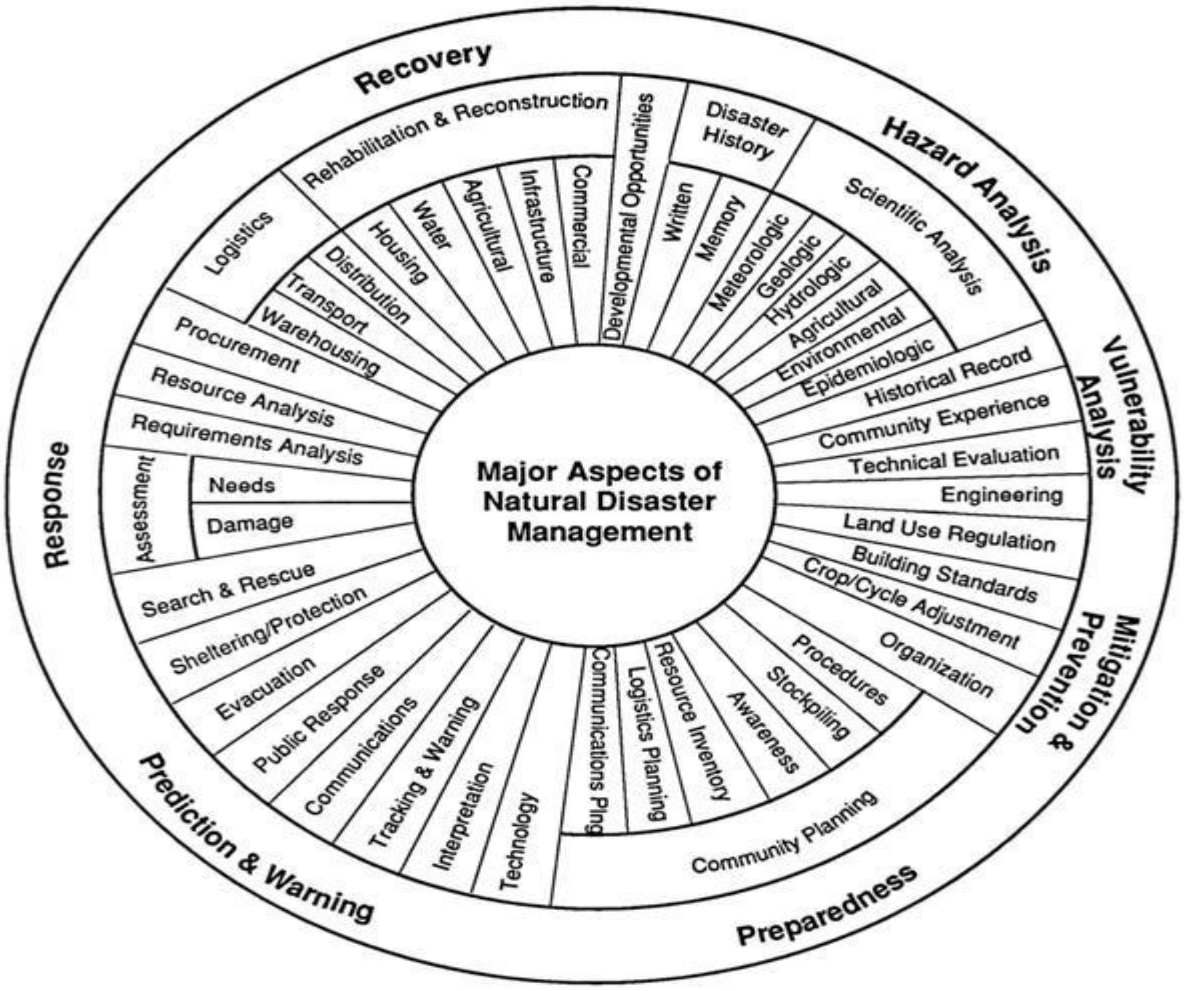
4 Integrated – ensure unity of effort among all levels of government and all elements of a community.

5 Collaborative – create and sustain broad and sincere relationships among individuals and organizations to encourage trust, advocate a team atmosphere, build consensus, and facilitate communication.

6 Coordinated – synchronize the activities of all relevant stakeholders to achieve a common purpose.

7 Flexible – use creative and innovative approaches in solving disaster challenges.

8 Professional – value a science and knowledge-based approach; based on education, training, experience, ethical practice, public stewardship and continuous improvement, Wayne Blanchard, (2007).



(Source: Maine Emergency Management Agency, 2007).

2.11 MAJOR ASPECT OF NATURAL DISASTER MANAGEMENT

2.12 Floodmobile Barrier

When deployed correctly the No Floods Mobile Barrier can divert/ hold back up to 120 cm of water depending on the model deployed. Due to the unique and innovative design and the materials used the No Floods Mobile Barrier shows extremely high strength but at the same time high flexibility. The tube system can be interconnected with our special junctions which facilitates an almost infinite prolongation of the Barrier. It can be deployed in various

configurations (circles, 90 degrees turns etc.) and on a high variety of surfaces (sand, grass, asphalt, concrete etc.).As the only system the NoFloods Mobile Barrier can not only be used preventively but also curatively (deployment directly in the water). This ability has been tested and certified by the French Sécurité Civile (Department of Civil Defence and Emergency Preparedness) Flood protection (2012).

This double ability makes the No Floods Mobile Barrier the single most efficient solution both before and after flooding has occurred (Flood Protection, 2012).It further stated that The No Floods Mobile Barrier replaces the traditional use of sandbags (1 km of No floods Mobile Barrier replaces the use of 150.000 sandbags, 2500 m3 sand and 149 truckloads of sand). The No Floods Mobile Barrier protects people, infrastructure and the environment with extremely low environmental impact as the barriers are made from 100% environmental friendly and recyclable materials and are mostly reusable.

2.13 Effect of Disaster

In this work disaster is considered to be an unprepared shocking event which has bad Effects on people and their properties in urban communities. According to Abdulhamid Ibrahim *et al.,* (2011) it produces a combination of shocks, loss of lives and properties Greater Zaria has been having repeated occurrence of disasters both from natural causes and from man induced incidences. There are constant cries and complains about the increase in the rate of occurrence of disasters in greater Zaria area. These disasters includes deposit of industrial waste, increase drainage blockage and urban flooding, increase collapse of buildings outbreaks of diseases(Malaria, Direar, colera, maningietis and bed flu) and rampant fire outbreak in residential, markets areas and offices. Many of these disasters are caused by

poverty, ignorance, ethnic plurality which creates competition for scarce resources, high population density, and room density, growth of squatter settlements or structures unplanned development of land use and road traffic accidents.

The Indian Ocean earthquake/tsunami disaster affected 12 countries. With its magnitude and extent, it was one of the most devastating natural disasters in history. The problems could be summarized as follows: Scientific Problems Lack of data, inadequate data sharing, poor communication of data, Duplication of data, Social Problems Political problem, Government structure and Relocation of people (GIS and Emergency Management, 2006).

The increasing frequency of disasters, coupled with a number of emerging threats and trends, are leaving more people vulnerable to the effects of disasters and inflicting greater damage, loss, and dislocation on vulnerable people worldwide. According to the Centre for Research on the Epidemiology of Disasters (CRED), in 2008, more than 235,000 people were killed by disasters, 2.14 million affected, while the cost of disasters was over 190 billion US$(Red cross and Red crescent societies, 2010).

2.14 Impact of Disaster

The UNISDR goes on to indicate: “Disasters are often described as a result of the combination of: the exposure to a hazard; the conditions of vulnerability that are present; and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injury, disease and other negative effects on human

physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation"(USAID, 2011).

Disasters do not respect persons and the trail of destruction that they leave behind is a common occurrence. Their effect or impact is usually felt across all sectors in society, at the community or individual level, which has led to push for the more multi-sectored approach to prepare and respond to disasters! The impact of a disaster may either be a direct or indirect one, its effect trickling into most homes and families in the community. The more obvious physical impact leads to the socioeconomic and emotional impact felt by the community. The intensity of the impact of any disaster is dependent on the preparedness level of the community or nation. Factors that increase the intensity of the effect of a disaster are poverty, environmental degradation, population growth, and lack of information and awareness about the Disasters that exist in the area, and the potential risk they pose to the community at large (Srinivas, 2005).

2.14.1 Types of Impact of disaster

A. Physical Impacts

The physical impacts of a disaster are the deaths and injuries, and the damage to property and the built environment. The built environment can be classified as infrastructure and service sectors such as electricity, water etc. The amount of deaths can lead to a reduction in the population, and thus the workforce, which will in turn have an impact on the socio economic sector of the community (Srinivas, 2005).

B. Social Impacts

Developed countries which have modern early warning systems and effective mitigation programmed are able to reduce the impact of natural Disasters whereas countries with less preparedness and inadequate mitigation efforts suffer more from natural Disasters . In the case of India, the human and economic losses from disasters are high in comparison to many other developing nations. According to an estimate by the World Bank direct losses from natural disaster are up to 2 percent of the India's GDP. More importantly, the impact of most of the disasters is disproportionately high on the poor (Yojana, 2012).

It is well recognized that the poor and vulnerable sections of the society are impacted disproportionately by disasters. Quite often they lose their homes, assets and livelihoods. While there is genuine concern about the adverse impact of disasters on GDP there is even more concern that our efforts to achieve 'inclusive growth' may not be successful unless Disaster Risk Reduction (DRR) is addressed (Yojana, 2012).

The new dimension of disaster loss in global economy It is being observed that in the time of globalization, disaster happening in one country is leading to huge loss in other countries. The damages of stock (infrastructure) are determining the flow Revenue of either neighboring or distantly located countries. For example, during the recent flood in Thailand the Federation of Thai Industries estimated that the damage of the record flooding to industry will total $6.2 billion. Disruptions were felt in Japan and to a lesser extent, in United States because the closed industrial estates host high-tech and automotive manufacturers like Western Digital, Seagate, Nissan, Toyota, Isuzu, ON Semiconductor, and TDK Magnecomp.

Four automotive factories, accounting for 630,000 Toyotas and 240,000 Hondas annually, have closed. Over 300 Japanese companies were directly affected by the disaster and estimates suggest they will take months to recover. In consumer electronics, the hard disk drive (HDD) industry also felt the flood's effects. California- based Western Digital is expected to see a 40 percent decline in its exports from Thailand, which is worth $6.5 billion a year, as two of its plants in Bang pa-in have been forced to close. Western Digital produces 33 percent of the world's HDDs and sells to major computer manufacturers like Acer, Dell, and Hewlett-Packard. Apple CEO Tim Cook said that Apple has suffered supply chain snags due to factory closures as well (Times of India on 3rd November, 2011). From Damage to Losses to Needs Assessment (Yojana, 2012).

The impact of disasters on development programmed, disasters can significantly impede the effectiveness of development resource allocation. The damage is done in many ways and the impacts can be as complex as the economy itself. It is for specific reasons that Practitioners explore the issues of lost resources to determine what will no longer be available to the country after a disaster such as assessing the effects of programmed interruptions and the switching of crucial resources to other, shorter-term needs as disasters often change the political, economic and social conditions within a country. There will also be a need to consider the negative impacts on investment climates (of the now declared disaster zone) to determine what opportunities will be left to attract local and international investment capital to the area or country that has been devastated by the disaster. And lastly, in what state will the disruption of the non-formal sector leave the disaster area in terms of citizens proceeding with their lives in ways closest to conditions before the disaster. This non-formal sector may

involve the way private citizen conduct business in their lives after the disaster (Srinivas, 2005).

2.15 Disaster Managers

The term "disaster manager" is applied to a person who has responsibility for planning and managing pre- and/or post-disaster activities. Disaster managers may be found in a variety of positions in many different types of agencies. The most prominent disaster managers are the personnel in governmental disaster preparedness agencies, national emergency or relief agencies, national reconstruction agencies, and emergency service agencies, departments or ministries. All require disaster management specialists. Municipal or provincial governments often have disaster managers. Large cities will often have a director of emergency services; and persons in public health departments, police departments, or public works departments may be assigned additional responsibilities in emergency management (Don schramm and Richard Hansen, 1993).

2.16 Agencies for Managing Disaster

Intergovernmental organizations often have specialized disaster or emergency management agencies. For example, the United Nations Disaster Relief Office (UNDRO) provides a wide variety of emergency management services to member governments. The United Nations High Commissioner for Refugees (UNHCR) and the United Nations Relief and Works Agency(UNRWA) provide specialized assistance to refugees.* Even within the non-disaster agencies of the United Nations, there are often special emergency management offices. Examples include UNICEF, which has an Emergency Unit; the World Health Organization, which has a Director of Emergency Relief Operations; and the Pan American Health

Organization (a regional office of WHO), which has an Emergency Preparedness and Disaster Relief Coordination office that focuses specifically on the Americas. The World Food Program also has a special Office for Emergency Relief (Don schramm and Richard Hansen, 1993).

Some nongovernmental organizations, both at the local level and at the international level, are specifically organized to provide emergency services. The most prominent of these are National Red Cross and Red Crescent Societies, the League of Red Cross and Red Crescent Societies, and the International Committee of the Red Cross. There are also hundreds of other private relief organizations throughout the world organized to provide specialized assistance to victims. These agencies range in size and scope from small, local ambulance corps to large U.N. agencies with scores of staff and multi-million dollar budgets, Aina (2004).Many nongovernmental development organizations (NGOs) have disaster specialists on the staffs. This is in recognition of the fact that disasters often occur where development agencies have normal programs, and they cannot avoid becoming involved in post-disaster activities. This is also because of the frequency in which NGO's are called on to assist disaster victims. The specialists help to develop disaster plans for their organizations and to manage post-disaster operations. Disaster management specialists can also be found outside of the systems specifically oriented towards disaster management or relief. Government ministries, such as agriculture, forestry, public health, defense, and public works, will often have major departments or key personnel assigned to disaster management or mitigation roles. It is common, for instance, to find a public works department employee who has assigned responsibilities for flood control activities. To be effective, that person must exercise

responsibility not only in flood fighting but also inland use, settlement planning and evacuation (Don schramm *et al.*,1993).

2.17 Building and Construction Industry Workplace Health and Safety Guide

2.17.1 Construction work reforms

Working in the building and construction industry is a risky business. Contractors, sub-contractors and their workers face risk from disaster that must be managed to prevent illness, injury and death (Workplace Health and Safety Regulation 1997).

The regulation cover:

1 Principal contractors construction safety plans

2 Work method statement for high construction activities and prescribe activities such as demolition work and asbestos removal work.

3 General and site specific induction

4 Signs

5 Housekeeping practices

6 Safety of plan provided for common use

7 Excavation (including trenches)

8 Working at height (including work on roofs from ladders and trestles ladder platforms, and work to erect or to dismantle scaffolding)

9 Protecting people from falling objects

10 Hazardous substance

11 Work place amenities

12 First aids

2.17.2 Fire prevention and protection procedure

To prevent and deal with occurrence of fire on site and to protect the works, the following actions are to be taken Mathew (2005).

:

1. No inflammable materials are to be stored on site within the building.
2. Photoelectric smoke detector warning alarms will be strategically positioned and protected on site on each floor of the building.
3. All the stairs will be made clear of debris and completely free of all obstruction so that they can be used as fire escape routes.
4. As part of the Health and safety briefing session, site personnel will be informed of evacuation plan.
5. The SM will have the telephone number of the fire station for quick contact:
6. Access for fire engine will be provided at the entrance to the site.
7. Two fire extinguishers will be made available on site. They will be inspected, and tested periodically by experts from outside ABC Limited.
8. There will be periodic fire drills throughout the duration of the project

2.17.3 Emergency Procedure

There are various problems and incidents, which could occur on site and which would require urgent attention. Hence, the need to have an emergency procedure on the site;

The center point of ABC Limited's emergency procedure is the prompt administration of first-aid to accident victims and to those who become ill until medical aid can be fully given by a medical doctor. This is paramount in order to ensure that the life of casualty is to be

sustained and recovery is to be promoted. It is ABC Limited's policy that our SM would have attended a course in first aid and has some knowledge of what to do in an emergency situation (GIS and Emergency Management, 2006).

2.18 Classification of Industries

Industries can be classified in a variety of ways. At the top level, industry is often classified into sectors: Primary or extractive, secondary or manufacturing, and tertiary or services. Some authors add quaternary (knowledge) or even quinary (culture and research) sectors. Over time, the fraction of a society's industry within each sector changes (Yojana, 2012).

They are-

Primary	This involves the extraction of resources directly from the Earth; this includes farming, mining and logging. They do not process the products at all. They send it off to factories to make a profit.
Secondary	This group is involved in the processing products from primary industries. This includes all factories—those that refine metals, produce furniture, or pack farm products such as meat.
Tertiary	This group is involved in the delivery and sale of goods. They include truck drivers and retail workers, for example.
Quaternary	This group is involved in the research of science and technology and other high level tasks. They include scientists, doctors, and lawyers.
Quinary	Some consider there to be a branch of the quaternary sector called the quinary

sector, which includes the highest levels of decision making in a society or economy. This sector would include the top executives or officials in such fields as government, science, universities, nonprofit, healthcare, culture, and the media (Jaffin Bob, 2008).

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter highlights the data collection procedure in the study. It also explains the parameter in the methodology such as the research design, data collection, and population of the study, sampling techniques, sample size, and method of data analysis. This research was pursued through a field work. .The Field work entails the use of the questionnaire as well as the interview of the respondents to establish their opinion on the industries preparedness for Disaster within the area of study.

3.1 Research Design

The research was design in such a way to asses/disaster preparedness in industrial buildings in Kano metropolis. A structured questionnaire was designed to obtained primary data. Detail of the study population, sample size; sampling method and method of analysis are given in other section of this chapter

3.2 Population, Sample Size and Sampling Techniques

With regards to the sampling size in the distribution of the questionnaire, the sampling size is determined based on the formula below considering the fact that the targeted population is known. (IWSD, 2003 in Macdonald, 2006).The targeted population for this research comprises of; sixty-four (64) industries in Sharada, thirty-one (31) industries in Challawa, sixty-two (62) in Bompai industrial and eleven (11) industries along Zaria road .this amounts to a total of one hundred and sixty-eight (168) industries within the study area. Based on this know population, the sample size is determined based on the formula below considering the fact that the targeted population is known. (Guilford and Flrucher (1973)

With regards to the sampling size in the distribution of the questionnaire, the sampling size will be)

$$\mathbf{n= (N/ (1+N (\alpha^2)}$$

Where;

n = the desired sample size

N = the Known Population size

Consequently, the sample size is determined as thus,

N = 168, $\alpha = 0.05$

Hence,

Sample size n = $[(168)/ (1 + 168 (0.05)^2) = 118.3$

Hence = 118.3

Thus the study will administer 120questionnaires.

Therefore one hundred and twenty (120) respondents were sampled in the area. The sampling technique adopted in the distribution of the questionnaires was simple random sampling technique

3.3 **Data Collection**

In order to collect data and to meet the set objectives of the research, a structured questionnaire based on the aim was designed. The questionnaire consist of section A and B. Section A was used to generate data on the respondents profile which include; size of industry, age of building, rating of structural stability category of respondent, and class of industries from the various scale of industries sampled, section B of the questionnaire was

used to gather information on the disaster preparedness in industrial buildings in kano Metropolis disaster likelihood and its severity impact as well as response mechanism and strategies in industrial building availability of evacuating facilities in the event of disaster in industrial building, rescue response expected from different organisation at the event of disaster in industrial buildings, public education/enligtment, training and other community based disaster preparedness, Respondent were asked to rate them on a 5-pointlikert scale Appendix 1 shows/the present of complete questionnaire.

3.4 Data Analysis

The data collected for this study were subjected to various statistical analyses using the computer based software "Statistical Package of Social Sciences" (SPSS). The results of the analysis are presented in the forms of table for the purpose of easy comparism and clear expression of the findings. The Mean were calculated for each document according to their frequency of use as suggested for use by Memon et' al, (2006) and Othman et' al, (2005)

It was calculated using the formulae

$$\text{Mean} = \frac{\sum fx}{\sum f}$$

Where,

$\sum fx$= is the total weight given to each attributes by the respondents

$\sum f$= is the total number of respondents in the sample

K = is the weight on the likert scale [1,2,3,4,5]

Data were also presented in graphic form namely tabulations. Descriptive analysis of data relating to rating/frequency, simple percentages were also used to analyse data.

Experimental results were presented in adequate table and with the adequate unit of measurement for a clear expression of the finding.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Preamble

This section encompasses result of the data analysis and the discussion of the data gotten from the questionnaire survey.

4.2 Response to Questionnaires Administered

A total of One Hundred and Twenty (120) questionnaires were administered to the various respondents within the area of study. A total of one hundred and nine questionnaires were received adequately filled giving a percentage response of 91.0%.

Table 4.1 Questionnaire Administered

Questionnaires	Frequency	Percentage of (%)
Administered Questionnaire returned	109	91.0
Administered Questionnaire not returned	11	09.0
Total Questionnaire Administered	**120**	**100.0**

Source: Field Survey, (2014)

4.3.1 Profile of Industrial Buildings Studied

Information regarding the features or Profile of the industrial buildings Sampled were analyzed and the results are as presented in Table 4.2.It can be deduced that a larger percentage of the industry sampled belong to the medium Scale Industry (52.5%), which was closely followed by equal amount of the Small and Large Scale industry (23.7%) each. Similarly with regarding to the life span of the industrial buildings studied, it can be deduced that a larger percentage of the building felt between the age bracket of 11-20years and above.

This also indicated that most of the industries studied were operating in old existing building with only few operating in new buildings.

Still on the Profile of the industrial buildings/ industries studied, Table 4.2 also indicated that there were more indigenous industries in the research area (18.3% for small Scale; 19.3% for medium scale and 6.4% for large scale industries); as against the foreign counterparts in the various scales of industries studied.

Finally with regards to the categories of the respondents from the various industries studied, it can be deduced that there were more Safety officer managers (14.8% for small scale industries, 36% for medium scale industries and 16.5% for large scale industries) as compared to the Human resource manager. This is an indication that the respondents were of reasonable knowledge on the relevance of health and safety in the industries.

Table 4.2 Profile of Industrial Buildings Sampled

S/N	Variable		Option	Frequency (No)	Percentage (%)
1	Size of Industry :		a) Small scale industry	26	23.7
			b) Medium scale Industry	57	52.5
			c) Large scale industry	26	23.8
			Total	**109**	**100**
2	Age of Building :		a) 0-10years	19	17.5
			b) 11-20yeras	48	43.5
			c) 21-30years	22	19.7
			d) 31-40years	13	12.1
			e) 41years and above	07	7.2
			Total	**109**	**100**
3	Rating of the Structural Stability of the Building		a) Not Stable	6	5.8
			b) Slightly stable	24	21.5
			c)Moderately Stable	25	23.3
			d) Stable	24	21.1
			e) Highly Stable	30	28.3
			Total	**109**	**100**
4	Class of Industries from the various scale of industries sampled	Small scale industries	a) Indigenous	20	18.3
			b) Foreign	6	5.5
		Medium scale industries	a) Indigenous	21	19.3
			b) Foreign	36	33.0
		Large scale industries	a) Indigenous	7	6.4
			b) Foreign	19	17.5
			Total	**109**	**100**
5	Category of respondents from the Various Scale of industry	Small scale industries	a) Human Resource Manager	10	9.1
			b) Safety Officer Manager	16	14.8
		Medium scale industries	a) Human Resource Manager	17	15.6
			b) Safety Officer Manager	40	36.7
		Large scale industries	a) Human Resource Manager	8	7.3
			b) Safety Officer Manager	18	16.5
			Total	**109**	**100**

Source: Field Survey, (2014)

4.3.2 Respondent's Perception of the Likelihood of Disaster

Table 4.3 presents the Mean Score of the respondents' perception on likelihood of disasters occurrence as well as the severity of the impact of the disaster occurrence. Several forms of disaster occurrence were identified and the opinion of the respondents regarding its likelihood of occurrence was sort.

It can be deduced that Environmental Pollution was ranked the highest. This was followed closely by: fire outbreak; Biological, Chemical Hazard; and Floods were ranked the second, third, and fourth hazard with the likelihood of happening respectively.

Also from the table it can be deduced that certain hazards identified has a very low tendency or likelihood of occurring as they were rated very low in the list of hazards identified. Such hazards include: Storm; Political unrest/ Civil Disturbance and Inclement Weather which were ranked the, twenty first, twenty and nineteen respectively.

Table 4.3: Ranking Of the Disaster Likelihood

S/N	Disaster	Likelihood Analysis							
		1	**2**	**3**	**4**	**N**	**TS**	**MS**	**Rank**
a.	Environmental pollutions	-	11	16	82	109	399	3.65	**1ST**
b.	Fire outbreaks	7	15	24	63	109	357	3.26	**2ND**
c.	Biological / Chemical hazards	3	16	43	47	109	355	3.25	**3RD**
d.	Environmental degradations	7	10	44	48	109	351	3.21	**4TH**
f.	Erosion	-	21	43	45	109	351	3.21	**4TH**
g.	Floods	6	15	40	48	109	349	3.20	**6TH**
h.	Communication failure	5	18	46	40	109	339	3.10	**7TH**
i.	Electric power failure	3	33	26	47	109	336	3.07	**8TH**
j.	Criminal activities	4	35	19	51	109	332	3.04	**9TH**
k.	Road traffic accidents	15	16	40	38	109	319	2.92	**10TH**
l.	Excessive settlement	2	33	48	26	109	316	2.89	**11TH**
m.	Chemical Explosions	9	30	38	32	109	309	2.83	**12TH**
n.	False majour	9	37	39	24	109	294	2.70	**13TH**
o.	Collapse of building structures	5	54	29	21	109	285	2.61	**14TH**
p.	Lightening	5	55	33	16	109	277	2.53	**15TH**
q.	Landslides	15	36	43	15	109	276	2.52	**16TH**
r.	Mud flow	27	61	21	-	109	212	1.94	**17TH**
s.	Radiological accidents	40	35	34	-	109	211	1.93	**18TH**
t.	Inclement weather	47	38	24	-	109	195	1.76	**19TH**
u.	Political unrest / Civil disturbances	49	44	16	-	109	184	1.69	**20TH**
v.	Storm	51	45	13	-	109	179	1.64	**21ST**

Where: 1 –Nil, 2– Low, 3 – Medium, 4- High
N= Number of respondents
TS= Total Score
MS= Mean Score

Source: Field Survey (2014)

4.3.3 Respondent's Perception of the severity of the Selected Disaster

The Table 4.4 also presented the respondents perception on the severity impact of the occurrence of such hazards. It is observed that the respondent ranked fire outbreak as the hazard with the highest severity on the event of it occurrence. In line with this, Radiological accident ranked second; falsemajour and Environmental degradation with both allied as the third highly severe hazards. Details and ranking of the severity of other various ranking are as presented in Table 4.4

Table 4.4: Ranking Of the Disaster Severity Impact

S/N	Disaster	Severity Impact Analysis						
		I	ii	Iii	N	TS	MS	Rank
	Fire outbreaks	6	11	92	109	303	2.78	**1ST**
b.	Radiological accidents	10	21	78	109	286	2.62	**2ND**
c.	Falsemajour	15	21	73	109	276	2.52	**3RD**
d.	Environmental degradations	13	26	70	109	275	2.51	**4th**
f.	Floods	22	13	74	109	272	2.49	**5TH**
g.	Collapse of building structures	13	31	65	109	270	2.47	**6TH**
h.	Erosion	10	40	59	109	268	2.45	**7TH**
i.	Communication failure	12	40	57	109	264	2.40	**8TH**
j.	Environmental pollutions	26	15	68	109	261	2.39	**9TH**
k.	Criminal activities	10	47	52	109	260	2.38	**10TH**
l.	Road traffic accidents	20	37	52	109	248	2.27	**11TH**
m.	Electric power failure	26	31	52	109	244	2.23	**12TH**
n.	Biological / Chemical hazards	11	66	32	109	240	2.19	**13TH**
o.	Chemical Explosions	28	32	49	109	239	2.19	**13TH**
p.	Lightening	7	86	16	109	230	2.10	**15TH**
q.	Excessive settlement	27	52	30	109	220	2.02	**16TH**
r.	Landslides	37	34	38	109	219	2.01	**17TH**
s.	Storm	27	80	2	109	194	1.78	**18TH**
t.	Inclement weather	46	43	20	109	192	1.76	**19TH**
u.	Political unrest / Civil disturbances	57	22	30	109	190	1.74	**20TH**
v.	Mud flow	78	15	16	109	158	1.44	**21st**

Where: i-low, ii- Medium; iii- High
N= Number of respondents
TS= Total Score
MS= Mean Score

Source: Field Survey (2014)

4.3.4. Perception of Disaster Occurrence in Industrial Buildings.

The frequencies of the occurrence of the identified hazards were also sort and the result of the analysis is as presented in the Table 4.5

Table 4.5: Mean Scores of the Frequency of disaster occurrence

S/N	Disaster	Frequency of occurrence							
		1	**2**	**3**	**4**	**N**	**TS**	**MS**	**Rank**
a.	Environmental pollutions	-	11	16	82	109	399	3.65	**1ST**
b.	Fire outbreaks	7	15	24	63	109	357	3.26	**2ND**
c.	Biological / Chemical hazards	1	17	43	48	109	355	3.25	**3RD**
d.	Floods	7	10	44	48	109	351	3.21	**4TH**
f.	Erosion	-	21	43	45	109	351	3.21	**4TH**
g.	Environmental degradations	6	15	40	48	109	350	3.20	**4TH**
h.	Communication failure	5	18	46	40	109	339	3.10	**7TH**
i.	Electric power failure	3	33	25	48	109	336	3.07	**8TH**
j.	Criminal activities	7	35	18	49	109	331	3.04	**9TH**
k.	Road traffic accidents	15	16	40	38	109	319	2.92	**10TH**
l.	Excessive settlement	3	32	48	26	109	316	2.89	**11TH**
m.	Chemical Explosions	9	30	38	32	109	309	2.83	**12TH**
n.	Falsemajour	10	37	39	23	109	294	2.70	**13TH**
o.	Collapse of building structures	4	54	30	21	109	285	2.61	**14TH**
p.	Lightening	6	55	33	15	109	277	2.53	**15TH**
q.	Landslides	15	36	43	15	109	276	2.52	**16TH**
r.	Mud flow	27	61	21	-	109	212	1.94	**17TH**
s.	Radiological accidents	40	35	34	-	109	211	1.93	**18TH**
t.	Inclement weather	47	38	24	-	109	195	1.76	**19TH**
u.	Political unrest / Civil disturbances	50	44	15	-	109	184	1.69	**20TH**
v	Storm	52	44	13	-	109	179	1.64	**21ST**

Where: 1 Never, 2 – Seldom, 3 – Frequent, 4- Very Frequent
N= Number of respondents
TS= Total Score
MS= Mean Score
Source: Field Survey (2014)

From the Table it can be established that Environmental pollution was ranked the most reoccurring hazard within the area of Study. This was followed closely by Fire out break;

Biological/Chemical hazard and Flooding, which were ranked the second, third and fourth most reoccurring hazards within the study area. Details of the frequencies of hazards are as shown in Table 4.5

4.3.5. Respondent Perception of the Effect of Disaster on Building Elements.

The area's most affected by previous disaster in the building alongside with the extent of the effect to lives and properties were sort. The result of the analysis of the respondents' opinion is as presented in Table 4.6

Table 4.6: Ranking of Areas of the effect of previous Disasters

S/N	Area of Disaster	WEIGHTNG/RESPONSE FREQUENCY								
		1	**2**	**3**	**4**	**5**	**N**	**TS**	**MS**	**RANK**
a	**Lives**	-	-	2	30	77	109	512	4.69	1ST
b.	**Properties**	-	8	15	35	51	109	455	4.17	2ND
c.	**Building**									
	i. Super Structure	-	14	17	30	48	109	441	4.03	3RD
	ii. Roofing	-	14	31	26	38	109	415	3.80	4TH
	iii. Sub- Structure	-	13	29	45	22	109	405	3.71	5TH

Where: 1- insignificant, 2-slightly significant, 3- Undeceive, 4- Significant, 5- Extremely significant
N= Number of respondents
TS= Total Score
MS= Mean Score
Source: Field Survey (2014)

From the Table it can be deduced that the respondents were of the opinion that the effect of the disaster was more on human lives which was ranked first. This was followed closely by the effect on properties with which was ranked second. In addition to the effect on human live and properties, it can be observed from the Table, that regarding the Effect on the building structures, the effect of such hazard according to the respondents perception is felt

more on the super structure, followed by the Roofing structure and finally on the sub-structure . Other details of the analysis are as elucidated in Table 4.6.

4.4 DISATER ADAPTATION MEAUSRE/PREPAREDNESS

This section presents the respondents' opinion on measures to adapt the disaster occurrences in the research areas i.e. to reduce exposure and vulnerability via future projection. Thus it further divided into sections that consider the developed responses mechanism and disaster preparedness alongside with disaster preparedness plan.

4.4.1 Developed Response Mechanisms and Strategies to Disaster Preparedness

The response mechanism and strategies of the industries under study was evaluated in line with the: installation, Equipment and Personnel. The results of the findings are as presented in Table 4.7.

Table 4.7: Ranking Of Response Mechanism and Strategies to Disaster Preparedness

S/N	Response Strategies		WEIGHTNG/RESPONSE FREQUENCY								
			1	**2**	**3**	**4**	**5**	**N**	**TS**	**MS**	**RANK**
a.	**Installations**	i. Measures to activate special installation such as mobile hospital facilities.	55	10	21	23	-	109	231	2.12	1ST
		ii. Preparation for emergency reception centres and shelters	39	8	2	43	17	109	320	2.93	2nd
		Iii .Procedure for activating distribution systems	53	11	2	40	3	109	255	2.34	3rd
b.	**Equipment**	ii. Procedures for activating emergency programs for transport	49	21	26	13	-	109	188	3.01	1st
		i. Preparation for storing or making arrangements for rapid acquisition of facilities	61	33	13	2	-	109	176	1.61	2nd
c.	**Personnel**	iv. Assessment process and information priorities for response	33	14	39	8	15	109	288	2.64	1st
		ii. Developed evacuation procedure	31	35	25	18	-	109	248	2.27	2nd
		i. Trained search and rescue team	55	32	18	4	-	109	191	1.75	3rd
		iii. Disaster assessment teams	82	11	4	12	-	109	165	1.51	4TH
		v. Developed emergency preparation, plans processes and procedures	87	18	4	-	-	109	133	1.22	5TH

Where: 1 =Poor, 2 = Fair, 3 =Good, 4= Very Good, 5= Excellent
N= Number of respondents
TS= Total Score
MS= Mean Score

Source: Field Survey (2014)

From the Table it can be deduced that on the basis of the Installations, there is a low procedure for activating distribution systems as it was ranked lease. Similarly 'Preparation for storing or making arrangements for rapid acquisition of facilities' is one of the equipment

poor response strategy common to most of the industry. With regards to the personnel response strategies adopted by most industries, it can be deduced that the development of emergency preparation plan and process is the leases strategy given attention by most of the industries in the research area. Details of other strategies as it relates to installation, equipment and personnel are as shown in Table 4.6

4.5.2 Disaster Preparedness Plans

An evaluation of the disaster preparedness plan of the various industries was carried out with the result of the analysis of the respondent perception are as shown in Table 4.8. from the result it can be observe that aside ‘Allocation of roles and specific responsibilities to personnel’ which was ranked first. Similarly, a closer look at the mean value of the various distributions tends to be closer to 2.0 (insufficient) than any other value in the linkert scale. This is an indication that the disaster preparedness of the industries based on the perception of the respondents is insufficient. Details of the ranking of the other identified disaster preparedness in the industry are as shown in the Table 4.8.

Table 4.8: Ranking Of the Disaster Preparedness Plans

S/No	Safety practice plan	WEIGHTNG/RESPONSE FREQUENCY								
		1	2	3	4	5	N	TS	MS	RANK
a.	Allocation of roles and specific responsibilities to personnel	16	23	20	40	10	109	333	3.04	1ST
b.	Determined chains of command and communication procedures	24	28	21	36	-	109	286	2.62	2ND
c.	Disaster preparedness policy statement	40	37	14	10	8	109	258	2.36	3RD
d.	Developed policies and procedures	40	27	25	9	8	109	246	2.25	4TH
e.	Functional stopcocks	38	30	21	20	-	109	242	2.21	5TH
f.	Described how relief supplies will be procured, stored and distributed	4	27	22	17	-	109	230	2.10	6TH
g.	Outlined response activities	49	21	26	13	-	109	221	2.01	7TH
h.	Identified organizational resources for disaster	52	18	38	1	-	109	208	1.91	8TH
i.	Publicized evacuation routes	55	28	11	15	-	109	205	1.88	8TH
	Identified sources of emergency life-line-services (e.g. water)	47	33	29	-	-	109	200	1.83	10TH
k.	Trained response personnel and people on what to do during disaster	56	36	15	2	-	109	182	1.66	11TH
l.	Identified emergency shelter sites to be used during disaster	65	22	16	6	-	109	180	1.65	12TH

Where: 1- Not available, 2- Insufficient, 3-Moderately Sufficient, 4-Sufficient, 5- Highly Sufficient
N= Number of respondents
TS= Total Score
MS= Mean Score
Source: Field Survey (2014)

4.6 EXISTING DISASTER MITIGATION STRATEGIES

This section presents the existing disaster mitigation strategies or measures in the area of study. Thus it is divided into other sub-sections encompassing the: The Availability Of Evacuation Facilities; Rescue Response Expected From Other Organizations; Information And Coordination Of Disaster Response Efforts And Resources With Other Rescue Organizations; Resource Mobilization For Disaster; and Public Education, Training, Rehearsal And Other Community-Based On Disaster Preparedness.

4.6.1 Availability of Evacuation Facilities

In addition to the disaster preparedness plan the availability of the various Evacuation facilities in the industry at the event of d occurrence of any disaster was also evaluated and the results are as presented in Table 4.9. The result shows that among all the evacuation facilities identified, Ramps was ranked highest, an indication that it is the most available evacuation facilities common to most of the industries. Further look at the result of the analysis indicates that the mean-value of most of the distribution were all closer to 2.0 (Insufficient) than any other value in the linkert scale. Thus, this suggests that the evacuation facilities in the industries studies were insufficient. Details of the frequencies and the ranking of other evacuation facilities identified are as elucidated in Table 4.9.

Table 4.9:Mean Score Of the Availability of Evacuation Facilities

S/No	Evacuation facilities	WEIGHTNG/RESPONSE FREQUENCY								
		1	2	3	4	5	N	TS	MS	RANK
a.	Ramps	15	26	27	19	22	109	333	3.04	1ST
b.	Escape smoke hood	22	14	40	26	7	109	310	2.84	2ND
c.	Escape rescue system	15	33	29	32	-	109	295	2.70	3RD
d.	Audible or visual Fire alarm system	11	43	46	9	-	109	272	2.49	4TH
e.	Disaster communication systems	43	21	18	27	-	109	249	2.28	5TH
f.	Fire, flooding, events	45	30	19	15	-	109	223	2.04	6TH
g.	Emergency escape lighting	56	18	19	14	2	109	218	2.00	7TH
h.	Photoluminescence emergency signage	26	74	6	-	-	109	209	1.91	8TH
i.	Double exit devices	43	46	14	6	-	109	201	1.84	9TH
j.	Public alert system	33	70	5	1	-	109	193	1.77	10TH
k.	Way-finding systems	47	39	23	-	-	109	193	1.77	10TH
l.	Fire escape stairs	77	16	10	6	-	109	162	1.48	12TH
m.	Escape chutes	65	33	11	-	-	109	164	1.50	12TH
n.	Automatic rescue climber	68	31	10	-	-	109	161	1.48	12TH
o.	Cranes	65	38	6	-	-	109	160	1.47	15TH
p.	The spider	91	18	-	-	-	109	127	1.16	16TH
q.	Portable evacuation chairs for disables	97	12	-	-	-	109	122	1.11	17TH
r.	Special evacuation lifts	98	11	-	-	-	109	120	1.10	17TH
s.	Rescuing air craft	109	-	-	-	-	109	109	1.00	19TH

Where: 1- Not available, 2- Insufficient, 3-Moderately Sufficient, 4-Sufficient, 5- Highly Sufficient
N= Number of respondents
TS= Total Score
MS= Mean Score
Source: Field Survey (2014)

4.6.2 Rescue Response from other Organizations

Rescue responses from other organization on the event of hazard occurrence were also evaluated. Based on the respondent perceptions the results of their opinions are as analyzed and presented in the in Table 4.10. From the Table it can be deduced that NEMA was ranked the highest organization that readily offer prompt Responses to the industry on the event of

Hazard occurrence. This was followed closely by 'Utility services departments; 'Health Departments and NGOs, which were ranked the Second, third, and fourth organizations that offers prompt responses respectively. Details of how prompt other organizations respond to the industry on the event of hazard occurrence as well as their ranking are as shown in Table 4.9.

Table 4.10: Rescue Response Expected From Other Organizations

S/N	ORGANIZATIONS	WEIGHTNG/RESPONSE FREQUENCY								
		1	**2**	**3**	**4**	**5**	**N**	**TS**	**MS**	**RANK**
a.	NEMA	-	22	17	49	21	109	396	3.63	1ST
b.	Utility services departments	-	17	31	48	13	109	386	3.53	2ND
c.	Health departments	-	31	28	37	13	109	361	3.30	3RD
d.	NGOs	5	21	33	43	7	109	353	3.23	4TH
e.	Civil defense	-	34	25	45	5	109	349	3.19	5TH
f.	Community based organizations	17	33	1	41	17	109	337	3.09	6TH
g.	Police	-	47	27	35	-	109	315	2.88	7TH
h.	Fire Service departments	-	65	11	25	8	109	302	2.77	8TH
i.	Red cross/Red crescent societies	26	57	21	5	-	109	224	2.05	9TH
j.	International agencies	47	48	14	-	-	109	186	1.70	10TH
k.	Other Government agencies	97	6	6	-	-	109	128	1.17	11TH

Where 1 = "No Response", 2= delayed response", 3= "undeceive", 4 = "Prompt Response" and 5= "Very Prompt Response"
N= Number of respondents
TS= Total Score
MS= Mean Score

Source: Field Survey (2014)

4.6.3 Disaster Response Efforts and Resources with Other Rescue Organizations

Aside the promptness of the responses from other organization to the industries on the event of any hazard the opinion of the respondents on the coordination of information between the organization and the industries on the vent of hazard was also sort. Table 4.11 presents the result of the analysis of the responses.

Table 4.11 Perception of Disaster Response Efforts and Resources with Other Rescue Organizations

S/N	ORGANIZATIONS	WEIGHTNG/RESPONSE FREQUENCY								
		1	2	3	4	5	N	TS	MS	RANK
a.	Community based organizations	7	19	5	56	22	109	394	3.61	1ST
b.	Utility services departments	10	16	15	48	20	109	380	3.48	2ND
c.	NEMA	1	24	27	49	8	109	373	3.42	3RD
d.	Health departments	9	16	31	40	13	109	361	3.30	4TH
e.	Police	27	8	18	35	21	109	342	3.13	5TH
f.	Civil defense	16	31	9	45	8	109	323	2.98	6TH
i.	NGOs	26	24	9	43	7	109	308	2.82	7TH
J.	Fire Service departments	16	65	-	10	18	109	275	2.52	8TH
k.	Red cross/Red crescent societies	55	8	20	23	1	109	237	2.17	9TH
l.	International agencies	60	25	14	10	-	109	192	1.76	10TH
m.	Other Government agencies	95	5	9	-	-	109	133	1.22	11TH

Where 1 = no coordination", 2 = "poor coordination", 3 = "moderate coordination", 4 = "good coordination" and 5= "high coordination"
N= Number of respondents
TS= Total Score
MS= Mean Score
Source: Field Survey (2014)

From Table 4.11 it can be deduced that the Community Based Organization had the best information coordination as it was ranked first. This was followed closely by "utility Services Department; 'NEMA; Health Departments and Police which were ranked Second, third, fourth and fifth respectively. However, the lease ranked organization are "other Government Organization(SEMA) which was ranked the eleventh. Details of the Ranking of other organizations are as shown in Table 4.11.

4.6.4 Resource Mobilization for Disaster

Table 4.12 presents a detail of how the resources are mobilized by the industries on the event of hazard occurrence.

Table 4.12: Disaster Resources

S/N	DISASTER RESOURCES	WEIGHTNG/RESPONSE FREQUENCY								
		1	2	3	4	5	N	TS	MS	RANK
a.	Relief transport and logistics	27	18	33	31	-	109	286	2.61	1ST
b.	Arrangements for use of outside equipment and services	22	33	33	21	-	109	272	2.49	2ND
c.	Creation of back-up-life-line services (e.g. power, water)	22	17	33	27	-	109	272	2.49	3RD
d.	Provision for emergency funding strategies	22	40	38	9	-	109	253	2.13	4TH
e.	Stockpiling, inventory and maintaining of disaster supplies and equipment	22	43	34	10	-	109	251	2.30	4TH
f.	Contacts with local and International emergency relief organizations	57	19	23	10	-	109	204	1.87	6HT
g.	Construction of temporary shelters	86	13	10	-	-	109	142	1.30	7TH
h.	Policies for acquisition and disbursement of aids	89	9	11	-	-	109	140	1.29	8TH

Where: 1= Not Available, 2= Insufficient, 3= Moderately Sufficient, 4=Sufficient, 5=Highly Sufficient
N= Number of respondents
TS= Total Score
MS= Mean Score
Source: Field Survey (2014)

From the results, it is observed that there sufficient resources are mobilized towards Relief Transport and logistics as it was ranked first. A close look at the mean-values of all the distribution also shows that the values are closer to 2.0 (insufficient) than any other number in the likert scale. Thus, this is an indication that disaster resources are insufficient. Thus, there is a need to make resource available to take care or absorb the effect of hazard occurrence. Further details of the ranking of the disaster resources are as shown in Table 4.12.

4.6.5 Public Education, Training, Rehearsal and other Community-Based on Disaster Preparedness

The level and strategy adopted by industries in educating the general public on the event of disaster occurrence was also evaluated. The results of the analysis of the responses are as presented in Table 4.13.

Table 4.13: Disaster Public Education

S/N	DISASTER PUBLIC EDUCATION	WEIGHTNG/RESPONSE FREQUENCY								
		1	**2**	**3**	**4**	**5**	**N**	**TS**	**MS**	**RANK**
a.	Education campaigns for those at risk	21	13	48	15	12	109	310	2.83	1ST
b.	Sponsoring media campaign for disaster awareness	28	6	58	17	-	109	282	2.58	2ND
c.	Maintenance and training of emergency services, e.g. emergency response teams	33	27	38	11	-	109	245	2.25	3RD
d.	Training of disaster response teams	32	40	22	15	-	109	234	2.17	4TH
e.	Rehearsals of emergency response scenarios	61	37	8	3	-	109	169	1.59	5TH

Source: Field Survey (2014)

Where: 1= Not Available, 2= Insufficient, 3= Moderately Sufficient, 4=Sufficient, 5=Highly Sufficient
N= Number of respondents
TS= Total Score
MS= Mean Score

It is observed that off all the disaster' public education measures suggested the respondents ranked 'Education campaigns for those at risk was ranked the highest and currently the most public education measure in use in the industries. In line with this, the corresponding mean-value (closer to 2.0-insufficient) indicate an insufficient disaster public education in most of the industries. Details of the ranking of other disaster public education are as shown in Table 4.13.

4.6.6 General Information on Disaster Preparedness

Finally, the opinion of the respondents were sort regarding if they are satisfied with level of the disaster preparedness in the industries; their confidence in the safety of life-line-services (such as gas, electricity, light) in this industry; and their level of satisfaction with the ability of the existing disaster preparedness in eliminating disasters. The result is as shown in Table 4.14. Expressed great dissatisfaction because owing to the Mean-values they were all closer to 1.0 (Not Satisfied). Details are as shown in Table 4.14.

Table 4.14: Disaster preparedness

S/N	DISASTER PREPAREDNESS	WEIGHTNG/RESPONSE FREQUENCY								
		1	**2**	**3**	**4**	**5**	**N**	**TS**	**MS**	**RANK**
a.	Are you satisfied with the level of disaster preparedness in this industry?	77	27	5	-	-	109	147	1.35	1ST
b.	Are you confident in the safety of life-line-services (such as gas, electricity, light) in this industry?	88	13	5	3	-	109	144	1.31	2ND
c.	How satisfied are you with the ability of the existing disaster preparedness in eliminating disasters?	99	8	2	-	-	109	123	1.12	3RD

Where: 1 = "not satisfied", 2 = "slightly satisfied", 3= "moderate satisfied", 4 = "satisfied" and 5= "highly satisfied
N= Number of respondents
TS= Total Score
MS= Mean Score

Source: Field Survey (2014)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The following are the summary of the findings:

1 Most of the industrial buildings studied were within the bracket of 11-20years (43.5%). Others were; 21-30years (19.7%); 0-10years (17.5%); 31-40years (12.1%) and only 7.2% of the buildings were within the age bracket of 41years and above.

2 Larger percentage of the respondent were of the view that the industrials buildings studied were stable though the extent of stability varies i.e.; 21-5 %(slightly Stable); 23.3% (moderately stable), while 28.3% were of the view that the buildings were Highly Stable. Only about 5.8% of the respondent opined that the industrial buildings were not structurally stable.

3 Environmental Pollution was ranked the highest and identified as the disaster with the highest likelihood of occurring. Other disaster with high tendency of occurring arrange in their order of severity are: fire outbreak; Biological, Chemical Hazard; and Floods ranked the second, third, and fourth hazard with the likelihood of happening respectively. Mshelgaru et al (2013) stated that some zones were more vulnerable to certain types of disasters, particularly those relating to natural environmental disasters than others.

4 Based on the Severity of occurrence of the Hazards, fire outbreak as the hazard with the highest sever effect on the event of it occurrence. In line with this, Radiological accident with ranked second; Arson or act of terrorism with and lightening are other disasters whose effect are severe as identified by the respondents arranged in their order of severity.

Reference to Table 4.4. Base on their findings Mshelgaru et al (2013) said that the anticipated severities of the potential disasters were found to have significant severities if allowed to occur.

5 Human lives was identified as the major loss on the event of hazard occurrence. This was followed closely by loss of properties. However, with regards to the building structure, the super structure was identified as the most affected area, followed by the Roofing structure and finally on the sub-structure

6 Measures to activate special installation such as mobile hospital facilities' identified as a good Disaster Response Strategy. Other viable strategy include: 'Procedures for activating emergency programs for transport as well as 'Preparation for emergency reception centers and shelters.See Table 4.7. Mshelgaru et al (2013) stated that 34% of the responses suggested non available or insufficient availability of preparedness plan efforts while 66% made significant efforts.

7 It was discovered that most industries lack or have insufficient disaster preparedness plan. This is established from the fact that the mean value of the various distributions tends to be closer to 2.0 (insufficient) than any other value in the linkert scale. An indication that the disaster preparedness of the industries based on the perception of the respondents is insufficient. See Table 4.8

8 It was also established that there were insufficient Disaster Evacuation Facilities in the industrial buildings studied. This is evident from the analysis of the responses as elucidated in Table 4.9. Mshelgaru et al (2011) in their study said only 45% overall efficiency of evacuation facilities were sufficient.59% was either insufficient or not available

at all. The only elements with good sufficiency were audible or visual fire alarm system, public alert system, fire escape stairs, emergency escape lighting and escape rescue system.

9 NEMA identified as organization that offers the most prompt Responses to the industry on the event of Hazard occurrence. This was followed closely by 'Utility services departments; 'Health Departments and NGOs, in the order of their urgency in response. Details are as shown in Table 4.9.In their study it was found that 71% rescue aid was expected from fire service department while the least expected 24% was form the international agencies Mshelgaru et al 2011). 66% of disaster response preparedness plan was in place to confront the disasters with only 41% available evacuation facilities and 60% disaster management plan.63% of those buildings benefit from early warning systems for information and 67% of the rescue assistance expected from rescue organizations could be realise

10 Similarly, with regards to the mobilization of resources in the case of disaster, it was discovered that that resources are usually not available to take care of disaster. Similarly, a close look at the mean-values of all the distribution also shows that the values are closer to 2.0 (insufficient) than any other number in the likert scale. Thus, this is an indication that disaster resources are insufficient see Table 4.12.

11 It is observed that off all the disaster' public education measures suggested the respondents observed 'Education campaigns for those at risk most common in the Industries under study. In a similar manner disaster public education, training rehearsal and campaign activities sufficiency of this sector stood at 65% with the least attention given to sponsoring media campaign for disaster awareness and rehearsals of emergency response scenarios.

12 Finally, the Respondent expressed dissatisfaction with level of the disaster preparedness in the industries; lack of confidence in the safety of life-line-services (such as gas, electricity, light) in this industry; and dissatisfaction on the ability of the existing disaster preparedness in eliminating disasters. Mshelgaru et al (2011) highlighted that indicated that 34% of these elements were either not available or not adequate but 66% of preparedness plan indicated moderately sufficiency to high sufficiency.

5.2 **Conclusion**

The following conclusions can be drawn on the basis of the objectives in the study are:

Environmental pollution is most likely as well as the most frequent hazard that is predominant in the area of study, thus endangering the lives of people within that area. Other common disasters that need to be taken in to close consideration are: Fire outbreak; Biological/chemical Hazards as well as flooding. Thus preference should be given to this kind of hazard in the Hazard preparedness plan as it is the most reoccurring hazard in the area of study. The study concluded that fire outbreak; Radiological Accidents; Arson or act of Terrorism and environmental degradation and flood are the most severe effect on lives and property arranged in their order of severity. Human lives identified as the major loss on the event of previous disaster much more than properties. Similarly with regards to the building structure, the Super structure also identified as the major area of structural failure at the event of any hazard.

Activation of Special Installation such as Mobile Hospital facilities and activation of Emergencies programme for transports within the industries are the viable strategies that can be used as a Disaster Response Strategy arranged in their order of efficiency.

Similarly, it was also established that in most of the industrial buildings in the area of study, either no or insufficient Disaster Evacuation Facilities. Thus, increasing the vulnerability to the occurrence of hazard within the industrial building.

Similarly, it was also established that in most of the industrial buildings in the area of study, either no or insufficient Disaster Evacuation Facilities. This consequently led to their inability to contain the effect of hazards at the event of such occurrence.

With regards to organizations that are prompt and readily respond to industries in any case of hazard, NEMA was identified as the most responsive organization to Industrial hazards.

In line hazards preparedness, it was also discovered that "education campaigns for those at risk' is the most feasible and effective disaster public education measure that can help the industries in handling issues of hazard occurrence.

Finally it was discovered that: respondents are dissatisfied with the level of disaster preparedness in the industries. Similarly, people are not confident of the safety of life-line-services (such as gas, electricity, light) in the industries. In order words, there is a general dissatisfaction on the ability of the existing disaster preparedness in eliminating disasters

5.3 **Recommendations**

Based on the findings of this research, the following recommendations were made:

1 Industry should develop disaster preparedness plan that are more encompassing, stating and taking into cognizance the various possible hazards that it is prone to.

2 In addition to the preference given to hazards that are frequent and that has higher likelihood, the severe nature of any hazard should be put into consideration especially in the design and construction of such industrial buildings and preventive measures taken.

3 The installation and maintenance of special installations and sensors to ensure their functionality in the industrial buildings can help to hinder the occurrence of hazard or possibly reduce its effect where its control becomes inevitable.

4 Government agencies should imposed the implementation of disaster preparedness plan mandatory for all industries prone to hazard before commencement

5 Other disaster response organizations should endeavor to make their response as prompt as possible as this will help reduce the effect of disaster in an event where it occurs.

6 Industries should ensure that adequate resources are allocation for disaster management.

7 Finally industries should device measure of carrying out frequent disaster public education especially via campaigns for those who are at risk in the industry by virtue of the nature of their work or the device the use in carrying out their work.

5.4 Area of Further Studies

I suggest that further studies be conducted on industrial and commercial buildings hazard emergency response measure, as well as mitigation and recovery measures as little work have carried out in this areas.

5.5 Contribution to Knowledge

1 From the result obtained in severity table, it shows that fire outbreak with mean value of 2.78 rank first followed by radiological accidents with mean value of 2.60 rank second which stand to be beneficial to government agencies like NEMA and other governmental organizations on their ongoing campaign to create awareness on the need for healthy safety working environment in Nigeria.

2 The result from the table of disaster preparedness it can be said that irrespective of the ranking, the respondent expressed great dissatisfaction owing to the mean values, they were close to 2.0(insufficint). Consequently, it will assist the stake holders of the industries to put more effort in disaster preparedness.

3 From the disaster resources table It shows that the mean value of all the distributions are closer to 2.0 (insufficient).It will assists the industries to see the need to make resources available to take care or observe the effect of disaster occurrence.

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APPENDIX I- QUESTIONNAIRE

DEPARTMENT OF BUILDING
FACULTY OF ENVIRONMENTAL DESIGN
AHMADU BELLO UNIVERSITY
ZARIA, KADUNA STATE

Dear Respondents;

We would be grateful if you can squeeze a little out of your tight schedules to complete the attached questionnaire. The questionnaire on '**An Evaluation Of Disaster Preparedness Of Industries in Kano Metropolis'** is divided into **sections 'A' to 'L'** and it is expected that someone with good knowledge of the state of disaster preparedness in industrial buildings should be the one to supply the required information. Fully completed information would be much more appreciated. Thanks

Yours sincerely

Shuaibu Nuru Mamman

NB: If you want to know the outcome of this study, please indicate your interest by providing your name, Tel No, and E-mail address on the last page of the questionnaire.

SECTION A: Particulars Of A Building

1. Name of Industry:……

2. Address of Industry:...…… ……...

3 What is the size of the industry?

   a) Small scale industry ( )
   b) Medium scale Industry ( )
   c) Large scale industry ( )

4. Approximate age of this building (please tick)

   a) 0- 10 yrs ( )
   b) 11 – 20 yrs ( )
   c) 21- 30 yrs ( )
   d) 31 – 40 yrs ( )
   e) 41- 50 yrs ( )
   f) Above 51 yrs ( )

5. Who owned the company?

   A) an indigenous owned b)a foreign owned

6. What is the use of this industrial building? (Please tick as many)

S/No	Uses	
1.	Leather	
2	Steel rolling mill	
3	Rubber/plastic	
4	Electrical fittings/cables	
5	Agrochemicals/fertilizer	
6	Building/civil construction	
7	Generator assembly	
8	Pharmaceuticals	
9	Gum Arabic	
10	Paint	
11	Groundnut oil processing	
12	Insecticide	
13	Food eg indomie,sphageti,e.t.c	
14	Textile	
15	Others	

SECTION B: Disaster, Risk And Vulnerability Assessment

*Please rate the Level of **Severity** and **Likelihood** of Occurrence of each potential disaster as well as areas of **vulnerability** using **"Low", "Medium"** and **"High"***

Serial number	***Disasters***	***Disaster analysis***							
		Likelihood					***Severity of impact***		
		Nil	***Low***	***Medium***	***High***		***Low***	***Medium***	***High***
1	Floods								
2	Inclement weather								
3	Arson or act of terrorism								
4	Storm								
5	Environmental degradations								
6	Landslides								
7	Mud flow								
8	Erosion								
9	Criminal activities								
10	Excessive settlement								
11	Radiological accidents								
12	Road traffic accidents								
13	Environmental pollutions								

14	Chemical Explosions								
15	Political unrest / Civil disturbance								
16	Biological / Chemical hazards								
17	Communication failure								
18	Electric power failure								
19	Lightening								
20	Fire outbreaks								
21	Collapse of building structures								

SECTION C: **Brief History Of Frequency Of Disasters Occurrence In This Locality**

Please rate the Level of frequency of Occurrence of each potential disaster.

Serial number	***Disasters***				
		Very frequent	***Frequently***	***Seldom***	***Never***
1	Floods				
2	Inclement weather				
3	Arson or act of terrorism				
4	Storm				
5	Environmental degradations				
6	Landslides				
7	Mud flow				
8	Erosion				
9	Criminal activities				
10	Excessive settlement				
11	Radiological accidents				
12	Road traffic accidents				
13	Environmental pollutions				
14	Chemical Explosions				
15	Political unrest / Civil disturbance				
16	Biological / Chemical hazards				
17	Communication failure				
18	Electric power failure				
19	Lightening				
20	Fire outbreaks				
21	Collapse of building structures				

SECTION D. Please Summarize The Intensity Of Effects Of The Past Disasters On The Following Items

Serial number	*Area of disaster*	*Measures*				
		Insignificant	*Slightly significant*	*Undeceive*	*Significant*	*Extremely significant*
1	Building					
	a. Sub-structure					
	b. super-structure					
	c. roofing					
2	Lives					
3	Properties					

SECTION E: Developed Response Mechanisms And Strategies To Disaster Preparedness

Key for the following questions: 1=Poor (much worse than expected), 2= Fair (somewhat worse than expected), 3 = Good (as expected), 4= Very Good (somewhat better than expected), 5 = Excellent (much better than expected

Please rate the quality of the following disaster response strategies

S/No	Response strategies	1	2	3	4	5
A	**Installations**					
i	Measures to activate special installation such as mobile hospital facilities.					
ii	Procedure for activating distribution systems					
	Preparation for emergency reception centres and shelters					
iii	**Equipment**					

B	Preparation for storing or making arrangements for rapid acquisition of facilities						
i	Procedures for activating emergency programs for transport						
ii	**Personnel**						
C	Trained search and rescue team						
i	Developed evacuation procedure						
ii	Disaster assessment teams						
iii	Assessment process and information priorities for response						
iv	Developed emergency preparation, plans processes and procedures						
v							

Section F: Disaster Preparedness Plans

*Please rate the quality of the following items of preparedness plans in this building by fill the corresponding blank**(where NA = "Not Available", IS = Insufficient", MS = "Moderately Sufficient", S = "Sufficient" and HS = "Highly Sufficient")***

S/No	Safety practice plan	NA	IS	MS	S	SH
1.	Disaster preparedness policy statement					
2.	Developed policies and procedures					
3.	Identified organizational resources for disaster					
4.	Outlined response activities					
5.	Allocation of roles and specific responsibilities to personnel					
6.	Identified emergency shelter sites to be used during disaster					
7.	Publicized evacuation routes					
8.	Identified sources of emergency life-line-services (e.g. water)					
9.	Functional stopcocks					
10.	Determined chains of command and communication procedures					
11.	Trained response personnel and people on what to do during disaster					
12.	Described how relief supplies will be procured, stored and distributed					

SECTION G: Evacuation facilities

Please rate the quality of the following items of preparedness plans in this building by fill the corresponding blank ***(where NA = "Not Available", IS = Insufficient", MS = "Moderately Sufficient", S = "Sufficient" and HS = "Highly Sufficient")***

S/No	Evacuation facilities	**NA**	**IS**	**MS**	**S**	**HS**
1.	Audible or visual Fire alarm system					
2.	Public alert system					
3.	Fire, flooding, events					
4.	Fire escape stairs					
5.	Emergency escape lighting					
6.	Portable evacuation chairs for disables					
7.	Ramps					
8.	Special evacuation lifts					
9.	Escape chutes					
10.	The spider					
11.	Double exit devices					
12.	Automatic rescue climber					
13.	Escape rescue system					
14	Escape smoke hood					
15	Cranes					
16	Rescuing air craft					
17	Disaster communication systems					
18	Photoluminescence emergency signage					
19	Way-finding systems					

SECTION H: Rescue Response Expected From Other Organizations

Please rate how the following organizations will likely response if there is a disaster in this building. (Please tick) ***(****where 1 = "No Response", 2= delayed response", 3= "undeceive", 4 = "Prompt Response" and 5= "Very Prompt Response*")

S/No	**Organizations**	**RESPONSE**				
		1	**2**	**3**	**4**	**5**
1.	NEMA					
2.	Civil defense					
3.	Fire Service departments					
4.	Health departments					
5.	Red cross/Red crescent societies					
6.	Police					
7.	Utility services departments					
8.	Other Government agencies					
9.	NGOs					
10.	International agencies					
11.	Community based organizations					

SECTION I: Information And Coordination Of Disaster Response Efforts And Resources With Other Rescue Organizations

What level of information and disaster response coordination plans and intentions exists between the managers of this building and the following organizations? Please tick the corresponding blank. ***Where NC = no coordination", PC = "poor coordination", MC = "moderate coordination", GC = "goo coordination" and HC = "high coordination"***

S/No	Rescue Organizations	NC	PC	MC	GC	HC
1	Federal Fire service					
2	Corporate fire service					
3.	Red cross/Red crescent societies					
4.	NEMA					
5	Civil defence					
6	Community based organizations					
7	Health departments					
8	Military					
9	NGOs					
10	Other Government agencies					
11	International agencies					
12	Utility services departments					
13	Others …					

SECTION J: Resource Mobilization For disaster

Please rate the quality of the following mobilization facilities and how sufficient they are in this building by ticking in the corresponding blank, ***where NA = "not available", IS = "insufficient", MS = "moderate sufficient", S = "sufficient" and HS = "highly sufficient"***

S/No	Disaster resources	NA	IS	MS	S	HS
1.	Construction of temporary shelters					
2	Policies for acquisition and disbursement of aids					
3	Provision for emergency funding strategies					
4	Contacts with local and International emergency relief organizations					
5	Arrangements for use of outside equipment and services					
6	Creation of back-up-life-line services (e.g. power, water)					
7	Stockpiling, inventory and maintaining of disaster supplies and equipment					
8	Relief transport and logistics					

SECTION K: Public Education, Training, Rehearsal And Other Community-Based On Disaster Preparedness

Please rate the quality of the following mobilization facilities and how sufficient they are in this building by ticking in the corresponding blank, ***where NA = "not available", IS = "insufficient", MS = "moderate sufficient", S = "sufficient" and HS = "highly sufficient"***

S/No	Disaster Public Education	NA	IS	MS	S	HS
1.	Rehearsals of emergency response scenarios					
2	Maintenance and training of emergency services, e.g. emergency response teams					
3.	Education campaigns for those at risk					
4.	Training of disaster response teams					
5.	Sponsoring media campaign for disaster awareness					

SECTION L: General Information On Disaster Preparedness

Rank the extent to which you are satisfied to the following disaster preparedness
(1 = "not satisfied", 2 = "slightly satisfied", 3= "moderate satisfied", 4 = "satisfied" and 5= "highly satisfied)

s/n	Disaster preparedness	1	2	3	4	5
A	Are you satisfied with the level of disaster preparedness in this industry?					
b.	Are you confident in the safety of life-line-services (such as gas, electricity, light) in this industry?					
C	How satisfied are you with the ability of the existing disaster preparedness in eliminating disasters?					

5. Please rate the structural stability of this building

   a) Not Stable ( )

   b) Slightly Stable ( )

   c) Moderately Stable ( )

   d) Stable ( )

   e) Highly Stable ( )

6. Comment generally on the disaster preparedness of this building

   ……
   ……
   ……

……
……
……
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……
……

NB: If you want to know the outcome of this study, please indicate your interest by providing the following information;

Your name:

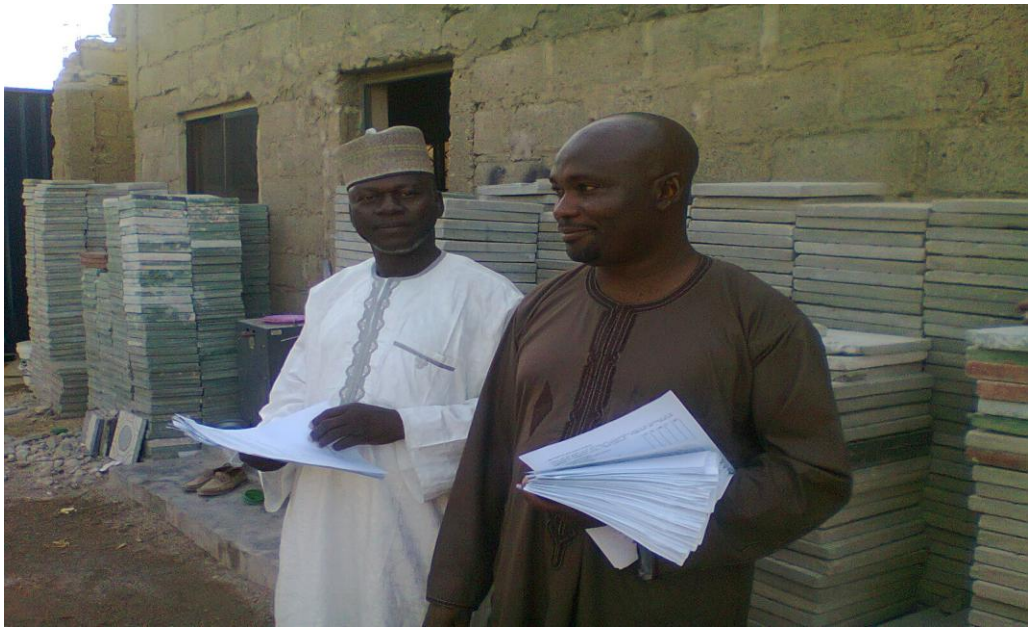
Telephone Number:

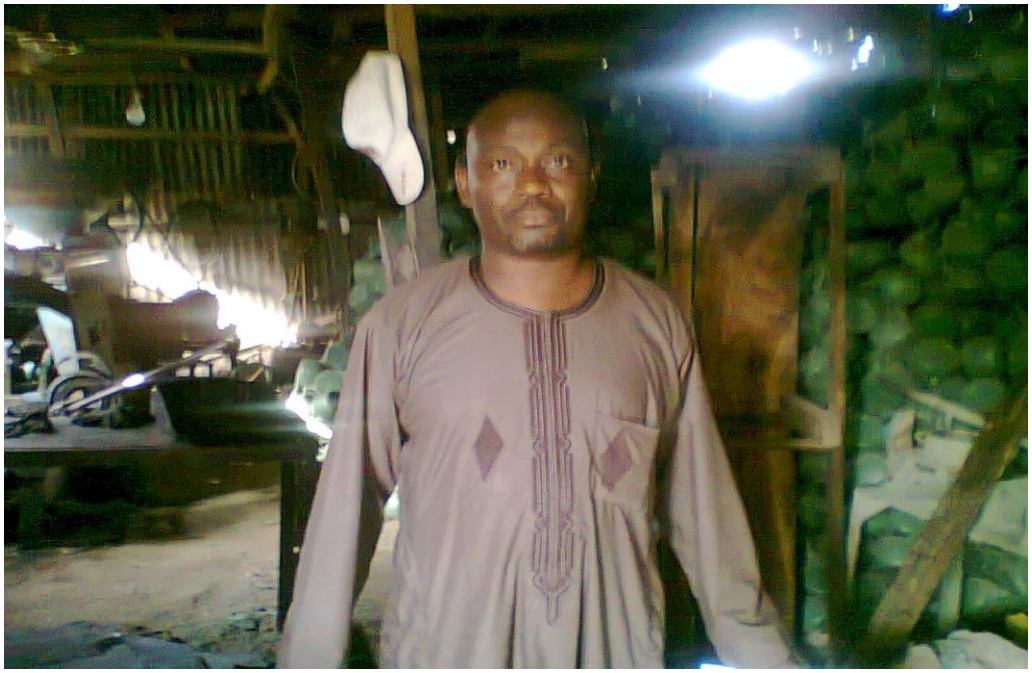
E-mail address:

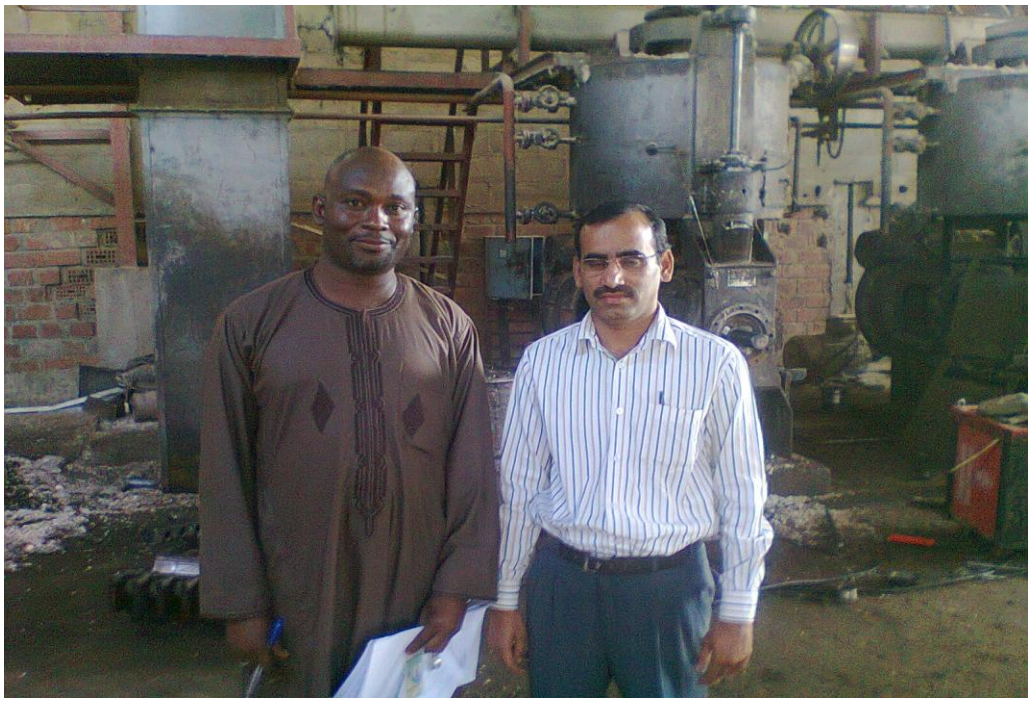
APPENDIX II PLATES


USAMA TRADING COMPANY
IMPORTERS EXPORTERS AND GENERAL MERCHANT


DINGLI PACKING MACHINERY





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54, Challawa Industrial Estate, Kano


MAMUDA INDUSTRIES NIG. LTD
Plot 16, Challawa Industrial Area,
Kano, Nigeria
R.C. NO. 25857
MAHAZA COMPANY LIMITED
Plot 17, Challawa Industrial Area,
Kano, Nigeria


FATA TANNING LIMITED
RC 356997
FATA
Plot 53, Challawa Industrial Estate
P.O. Box 201 Kano


POPULAR FARMS & MILLS LIMITED
RC 808405
54, Challawa Industrial Estate, Kano
Stallion


Krem
Spray


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