Community-Based Hazard and Vulnerability Assessment: A case study in Lusaka Informal Settlement, City of Tshwane

A mini dissertation submitted in partial fulfilment of the requirements for the Degree of Masters in Disaster Risk Management

Thabang Karneels Abel Thinda

Student no: 1997 54466 1

University of the Free State

Faculty of Natural and Agricultural Sciences

Centre for Disaster Risk Management Education and Training for Africa

Supervisor:
Maryna Strydom

DATE: MAY 2009

TABLE OF CONTENTS

LIST OF TABLES

EXECUTIVE SUMMARY

A new Act on Disaster Management has been introduced in South Africa that have shifted the focus of Disaster Management to a more pro-active approach in many municipalities. The Disaster Management Act, Act 57 of 2002, states that all Municipalities should provide for: “An integrated and co-ordinated disaster management policy that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, emergency preparedness, rapid and effective response to disasters and post disaster recovery”.

Community-based disaster risk management (CBDRM) is an approach which aims to reduce local disaster risks through the application of participatory assessment and planning methods. It is a practical bridging strategy to integrate local development efforts on one hand with strategies that reduce the impact of priority disaster risks on the other. It is a process in which at-risk communities are actively engaged in the identification, analysis, treatment, monitoring and evaluation of disaster risks in order to reduce their vulnerabilities and enhance their capacities. This means that people are at the heart of decision-making and implementation of disaster risk management activities. Community-based disaster risk assessment provides the community and support role-players with disaster risk specific baseline data that can be integrated into CoT Disaster Risk management Plan for development planning purposes.

It is important to identify the communities that are at risk of any disasters and to introduce risk reduction programs and strategies to ensure that any foreseeable disasters and their impacts on the community are limited as much as possible. It is thus important that a community-based hazards and vulnerability assessment be conducted with the goal of building a resilient community for the City of Tshwane. The Act thus, gives explicit priority to the application on the principle of co-operative governance for the purpose of disaster risk management and emphasizes the involvement of all stakeholders in strengthening the capabilities of national, provincial and municipal organs of state to reduce the likelihood and severity of disasters.

The main objective of the research is to gather all available information on identified hazards and the assessment of the community vulnerability and its capacity to cope or deal with these hazards in Lusaka informal settlement and to use this information to perform a community-based hazard and vulnerability assessment framework as well as the development of risk profile for Lusaka.

The purpose of this study is to develop a community-based hazard and vulnerability framework using the progression of vulnerability model to identify the root causes (problems) and the underlying pressures within Lusaka informal settlement's community. The information provided in this study was intended to assist in identifying hazards and vulnerabilities thereby building a disaster resilient community by sharing local hazards and also establishing community structures. Combining the results of the theoretical framework and research findings with the argument constructed in the dissertation about the community-based disaster risk management; it was found that it is possible to reduce hazard risks, and vulnerability to disasters, through the application of the "Progression of Safety" model and the participation of the community in disaster risk management activities.

The Pressure and Release model (PAR model) is introduced in this research as a simple tool to assist in up-rooting the problems underlying the Lusaka community and part of the research project for showing how disasters occur when natural hazards affect vulnerable people. Their vulnerability is rooted in social processes and underlying causes which may ultimately be quite remote from the disaster event itself. This model is successfully utilized to set the parameters for the community-based hazard and vulnerability Framework as proposed. The "Progression of Safety" model provides a much wider scope for the application of risk reduction strategies as what are usually instituted in disaster risk reduction measures and strategies. This research is not only focusing on measures pertaining to hazard and vulnerability reduction and the provision of safer living conditions, but also analyzed ways in addressing the root cause, reducing the dynamic pressures, namely better service delivery for utilities such as Health, Water and Sanitation, Road & Stormwater and Electricity.

It is evident that the CBDRM involves undertaking precautionary and timely measures to minimize the effects of hazards and vulnerabilities on the community. This approach is therefore people-centred in nature require full co-operation and effective participation of the "At Risk" communities in their planning and implementation of this process. Community-based hazard and vulnerability assessment is therefore important for developmental programs and projects of any municipality in order to realize their developmental agenda in line with the City of Tshwane Disaster Management Framework and the Disaster Management Plan level 1.

The researcher concludes the research thesis by suggesting recommendations for the CoT to implement the CBDRM framework for the sake of the community and also assisting them to

identify local hazards and vulnerabilities so that the CoT can review and update their Disaster Management Plan level 1. The researcher further more highlighted that community-based disaster risk management theory and its application are relevant for the study, as it emphasizes the conscious and participatory application of integrated measures in order to achieve identified objectives for the betterment of the lives of affected communities.

Recommendations were then made to the City of Tshwane on the application of community-based disaster risk management approach in hazard and vulnerability assessments, that should provide the municipality with a cost effective and scientific method of addressing Disaster Risk Management related functions.

Disaster risk reduction measures must be enforced within communities and municipalities through the use of excellent community-based hazard and vulnerability assessment and thus mitigations strategies. The successes in the implementation of these measures lie in the communities' physical, social, economic and political structures. These structures should be carefully analyzed and disaster risk reduction measures should be done in a way that minimizes the constraints found within these structures (relating to disasters), while strengthening local resources with the aim of achieving safe and healthy environments which is also in line with the City of Tshwane 'safer City policy'.

DECLARATION

I, the undersigned, hereby declare that the work contained in this dissertation submitted for the degree of Magister in Disaster Risk Management at the University of the Free State, is my own original work, that all sources used or quoted, have been indicated and acknowledged by means of complete references, and that this dissertation was not previously submitted by me or any other person at any other university for a degree. I hereby forfeit any copyright of this thesis to the University of the Free State.

Signature: ……..

Thabang Karneels Abel Thinda

Date: ……..

ACKNOWLEDGEMENT

I wish to express my sincere gratitude and appreciation to the following individuals and institutions that contributed in many ways to the completion of this thesis:

T hanks to:

- My fiancée, Nkele Florah Moshidi, for granting me her valuable advice, support, patience and love during my sleepless hours.
- My family and friends for their understanding and support.
- To Vuyiswa Agnes Makoa with her outstanding support throughout my career, may God bless you.
- To Prof. Frans Swanepoel whom I couldn't have been where I am if it wasn't because of you, may you also prosper in life.
- Marina Strydom, my supervisor, for her guidance and valuable and much appreciated input and guidance throughout my research thesis.
- Mr. Kometsi Zachariah Khotlele and Ms. Nhlanhla Grace Simelane for their great efforts in analysing, editing my research, advice and words of encouragements.
- The City of Tshwane Disaster Management Official from the Community Preparedness section (Mr. Ishmael Makaudi) for agreeing to the interview.
- The community of Lusaka informal settlement, Ward 10 for their patience and participation in this research.

All the community members, NGO (Nditshedza Development project (Mr. J. Khangele), disaster management ward committee members and ward 10 councillor (Clr. Mogaladi) who allocated the ward committee members and volunteers to assist and participate in this study for their trust, patience and time, and their willingness to share in such a benevolent manner, their innermost thoughts and livelihoods with the team.

ACRONYMS

ADPC	- ASIAN DISASTER PREPAREDNESS CENTRE
CBDRM	- COMMUNITY-BASED DISASTER RISK MANAGEMENT
CBHVA	- COMMUNITY-BASED HAZARD AND VULNERABILITY ASSESSMENT
COT	- CITY OF TSHWANE
DMA	- DISASTER MANAGEMENT ACT
DMC	- DISASTER MANAGEMENT CENTRE
DMTP	- DISASTER MANAGEMENT TRAINING PROGRAM
IDP	- INTERGRATED DEVELOPMENT PLAN
ISDR	- INTERNATIONAL STRATEGY FOR DISASTER REDUCTION
NDMF	- SOUTH AFRICAN NATIONAL DISASTER MANAGEMENT FRAMEWORK
SA	- SOUTH AFRICA
TIEP	- TSHWANE INTEGRATED ENVIRONMENTAL PLAN
THE ACT	- SOUTH AFRICAN THE DISASTER MANAGEMENT ACT, ACT 57 OF 2002
UN	- UNITED NATIONS
UNDP	- UNITED NATIONS DEVELOPMENT PROGRAM
UNDMTP	- UNITED NATIONS DISASTER MANAGEMENT TRAINING PROGRAM
UNCRD	- UNITED NATIONS CENTRE FOR REGIONAL DEVELOPMENT

GLOSSARY

The following key terms will be used in this research and shall have the following meaning:

- Community- A coherent, social group of persons with interests or rights in a particular area of land which the members have or exercise communally in terms of an agreement, custom or law (ISDR, 2003).
- Disaster- refer to 'a progressive or sudden, widespread or localised, natural or man-made occurrence which-
  a) Cause or threatens to cause-
     - Death, injury or disease;
     - Damage to property, infrastructure or the environment; or
     - Disruption of the life of a community; and

  b) Is of a magnitude that exceeds the ability of those affected by the disaster to cope with its effects using only their own resources' (Government gazette, 2002).
- Disaster risk management- disaster risk management refers to integrated multi-sectoral and multidisciplinary administrative, organisational and operational planning processes and capacities aimed at lessening the impacts of natural hazards and related environmental, technological and biological disasters. This broad definition encompasses the definition of 'disaster management' as it is used in the Disaster Management Act, 2002 (Government gazette, 2002).
- Veld fire - Veld fires means fires in South Africa that result in the burning of grass, shrubs and trees in a single event. These can occur in national parks and rural areas as well as within the urban fringe around cities and towns.
- Hazard- A hazard is a physical situation with a potential for human injury, damage to property, damage to the environment or some combination of these. It is a potential damaging phenomena (hazard) only has the potential of becoming a disaster event when it occurs in populated areas where it can cause loss of life or major economic losses (Allen, 1992).
- Hazard assessment- The identification of potential harm and injury. It is a necessary first step toward realistic risk assessment, but the estimation of actual risks also depends upon the analysis of potential exposures of defined persons and groups to individual hazards (Government gazette, 2005).
- Informal settlements - This is the residential areas that do not comply with local authority requirements for conventional (formal) townships. They are, typically,

unauthorized and are invariably located upon land that has not been proclaimed for residential use. They exist because urbanization has grown faster than the ability of government to provide land, infrastructure and homes. Informal settlements tend to be characterized by:

- Infrastructure that is inadequate
- Environments that are unsuitable
- Population densities that are uncontrolled and unhealthily high
- Dwellings that are inadequate
- Poor access to health & education facilities and employment opportunities
- Lack of effective government and management.

- Shack (informal settlement) fires - A fire that occurs in a dwelling that has not been formally approved or constructed in compliance with municipal building codes and regulations. Usually, such fires occur in informal settlements, which are densely congested residential areas, often lacking basic amenities and services such as piped water and electricity. An informal structure could also be a Wendy house or similar structure in the back yard of an approved building/home that is occupied by people.
- Risk- The probability of harmful consequences or expected losses (deaths, injuries, property, livelihoods, disrupted economic activity or environmental damage) resulting from interactions between natural or human-induced hazards and vulnerable conditions (Government gazette, 2005).

For the purpose of this study, risk is defined as the possibility of suffering harm from a hazard that can cause injury, disease, economic loss or environmental damage. Risk can be expressed in terms of:

- *A probability:* a mathematical statement about how likely it is that some event or effect will occur, or
- *Frequency:* the expected number of events occurring in a unit time (Allen, 1992).

- Risk assessment- "A process to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm people, property, livelihoods and the environment on which they depend" (Government gazette, 2005).
- Vulnerability- Blaikie *et al* (2004), define vulnerability as the characteristics of a person or group and their situation that influences their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard.

CHAPTER ONE:

INTRODUCTION AND BACKGROUND

1.1. INTRODUCTION AND BACKGROUND

The Disaster Management Act, No 57 of 2002 (Government gazette, 2002), hereafter referred to as 'the Act', requires the establishment of a National Disaster Management Centre (NDMC) responsible for promoting integrated and co-ordinated national disaster risk management policy (Government gazette, 2005). According to the national disaster management framework (Government gazette, 2005), the Act gives explicit priority to the application of the principle of co-operative governance for the purpose of disaster risk management and emphasizes the involvement of all stakeholders in strengthening the capabilities of national, provincial and municipal organs of state to reduce the likelihood and severity of disasters. The Act also calls for the establishment of arrangements for co-operation with international role players and countries in the region (Government gazette, 2005).

The possible explanation for this unequal distribution of disasters could be the result of the three basic needs of man, namely, food, shelter and safety. The best places for man to settle are where these three needs can most easily be satisfied. Locations where all these needs of man are met are very limited (Zschau and Küppers, 2003). As the world's human population has grown over the years these ideal locations have become very densely populated, eventually forcing people to move from these sites to areas that are less suitable for human habitation. Since the 1960's the world's population doubled from 3 billion to an estimated 6 billion in 2000 (Skidmore, 2002).

The world's urban population continues to grow faster than the total population of the world. The estimated 3 billion people living in urban areas in 2003 are expected to rise to 5 billion by 2030 (UN, 2004). Vulnerability' tends to mean different things to different scientific groups. In a disaster context, 'vulnerability' is applicable only in relation to specific hazards or interactions thereof, and can be seen to have two basic elements: exposure and susceptibility to harm. Exposure is determined by where and how people live and work relative to a hazard. Susceptibility takes into account those social, economic, political, psychological and

environmental variables that intervene in producing different impacts amongst people with similar levels of exposure (White et al., 2005).

When people move into areas that are less suitable for habitation, they will be taking a calculated risk, because the benefits of settling in the specific location will outweigh the drawbacks. Areas which are prone to flooding, for example, are often some of the most popular locations for human settlement, because of the advantages of being close to the employment areas, even though there will always be the danger of flooding (Blaikie, 1994). According to Blaikie (1994), man puts himself at risk by knowingly living in an environment that is not always entirely safe. Sometimes he puts himself at risk by not being aware of a hazard in his environment.

Community-based disaster management can be seen as risk reduction programs designed primarily by and for the people in certain disaster-prone areas. Disaster mitigation using government and institutional interventions alone is insufficient because they pay little attention to addressing the community dynamics or perceptions (APDC, 2003). At the same time, local communities are often either unaware of these formal disaster management interventions or they find the interventions inappropriate due to the lack of recognition of community's vulnerabilities and capacities, or they lack the external resources or technical support to supplement their own initiatives and capacity. Just as every individual, family, organization, business, and public service within a community will be affected by a disaster; each has a role to play in managing disaster. Looking at it practically, the multitude of actions must be taken to implement an effective disaster management program requires the participation of the entire community (APDC, 2003).

Another reason for implementing community-based approaches is that communities are knowledgeable about the hazards occurring in their environment and are able to anticipate them in some cases. They may not be scientific but the richness of experience and indigenous knowledge is a resource to be recognized (APDC, 2003). These resources need to be tapped and developed. In many cases, we learn that with proper training and information the communities are able to safeguard and minimize the disaster risks. It is essential that local capacities be strengthened to assess risks and develop mitigation strategies that are based on the communities' human, financial, information and material resources (APDC, 2003).

Over the last two decades there has been a growing realization that disaster management is most effective at the community level where specific local needs, resources, and capacities are met (APDC, 2003). It is at the local level that the physical, economic, political and social risks faced by the poor can be adequately assessed and managed. Some initiatives in this direction have come up in recent years. In modern times people have come to know their environment a lot better and can take mitigating measures to minimize the impact of hazards. However, as population grows, more people move into hazardous areas and today many more people are at risk of disaster than was the case in the past (Skidmore, 2002). Today people often do not have a choice but to live in hazardous areas because of economic, environmental and demographic reasons. Modern man is often forced to live in a particular area by economic factors, such as the availability of work. Thousands of people flock to cities where they hope to find work and make a living (Blaikie, 1994).

The result is that at present more people are living in hazardous areas and a much higher number of people are threatened by disaster (Skidmore, 2002). The impact of disasters is also much bigger than they would have been in the past, because the total number of people exposed to hazards is much higher than it was the case in the past. The frequencies of destructive events related to atmospheric extremes are also on the increase. During the last decade, a total of 3 750 wind storms and floods were recorded worldwide, accounting for two thirds of all disaster events (Skidmore, 2002).

In our society there are many more hazards that do not have a huge impact in such a short time frame or over a large geographical area, but are still a threat to the community. Over a longer time span many more people are killed and affected by day to day events such as car accidents and diseases that might be the result of the pollution and degradation of our environment (Miller, 1999).

The research focus on the case study in one of the informal settlement area called “Lusaka” which is situated in Mamelodi East, ward 10 in the City of Tshwane (CoT, 2003).

Figure 1: South African map showing Pretoria.

The main aim of this research study is to conduct a community-based hazard and vulnerability risk assessment in Lusaka informal settlement within the CoT. The general objectives is to gather all available information on identified hazards in the Lusaka and to use this information to perform a hazard and vulnerability risk assessment of Lusaka informal settlement with the aid of community participation. The information provided in this study is intended to assist in building a disaster resilient community by sharing knowledge and raising awareness of the inherent hazards in Lusaka settlement.

The findings and recommendations of the study can also be extrapolated and adapted to other areas in similar circumstances within the CoT because of similar characteristics of informal settlements areas. On completion, the hazard and vulnerability analysis, also including the capacity analysis within the community, will provide the CoT with the next logical step for prioritizing hazard mitigation initiatives and implementing the risk reduction projects.

From this study it will be possible for decision-makers to allocate resources to where they are most needed; therefore the community will also have the opportunity to buy-in on the projects intended for implementation whether for further research on hazards or mitigating actions in vulnerable areas within the CoT. The community will therefore be the sole beneficiary of the research because they will be the ones to participate on the identified projects. The community based disaster risk management will be used as the theoretical framework in this study. In this

chapter, an introduction and background of research, problem statement and research hypothesis, research questions, aim and objectives of the study, the study area, research design and methodology are presented.

1.2. PROBLEM STATEMENT

The problem statement underlying this study is:

Housing is one of the most important elements in terms of the social, physical, and economic aspects of community life. The house is both a shelter and a link to the neighbourhoods and the larger community. In today's parlance, the house is an environment. Inadequate, unsanitary and unsafe housing can affect the physical health, mental health, privacy and security of citizens. Slums or squatter settlements, which are neighbourhoods and areas of poor housing, have long been associated with crime, social disorder and other social and environmental problems (CoT, 2006).

The major features of poor housing are overcrowding and a lack of basic sanitation. In unplanned settlements with a high density of dwelling units and people, the problem of human body waste is a major health issue. Lack of proper sanitation is responsible for causing and spreading diseases. The leading causes of deaths include enteric diseases, cholera, typhoid and diarrhoea.

Apart from the crowded houses of Lusaka informal settlement, the most serious environmental problem is poor drainage and its two consequences: erosion and stagnant water. Because a proper drainage system is lacking, water and rubbish tend to collect and stagnate on the street corners, and on the riverbanks, causing odours and providing breeding grounds for pathogens. The stream is laden with filth of all types, including raw faeces. Vectors such as flies, mosquitoes, rats, chickens, ducks, and goats contribute significantly to the spread of disease. With its general substandard environment and its low-income-earning population living in crowded conditions with few or no services, Lusaka informal settlement seems to be in need of improvements. According to City of Tshwane report (2003), the standard of housing in Lusaka ranges from average to poor, with 34 to 60% of households living below the poverty line. Household sizes vary between two and four, and only in the south-east do they exceed four people. The rest of consists mainly of informal residences accommodating approximately 70% of the population in the ward. Very little or no protection is offered against the elements, whilst

the location also renders the occupants vulnerable to flooding and shack fires. CoT (2007) add that these people are amongst the poorest in the CoT, that they have only a few options, a limited income to facilitate a move, and only a few resources to help them recover after the floods.

Only 57% of the population use electricity from the municipality for cooking, and only one fifth of the residents have running water inside their houses. One in ten persons uses a bucket for a toilet. The infrastructure is there but it cannot be maintained because people have erected their dwellings on the pipelines and sewerage pipes. People in Lusaka have varied levels of access to services, including regular refuse removal and sanitation services. Poverty and a lack of knowledge in these areas may lead to littering. Overflow from unmaintained or broken sewerage pipes and reservoirs and unmanaged waste are other sources of land pollution.

Urbanization and the shortage of housing among the poor in the developed and developing countries lead to the development of informal settlements (Blaikie, 1994). The interrelationship that occurs between the informal settlers and the surrounding environment leads to the deterioration and destruction of the land, water and air quality within informal settlements. This deterioration eventually leads to poor environmental and living conditions. These settlements are in many cases devoid of decent shelter and basic infrastructure which result in terrible living conditions (Blaikie, 1994).

The CoT is experiencing an increasing number of deaths and indents due to shack fires and floods within the informal settlements. Because of rapid urbanisation, people tend to settle in high risk and vulnerable areas in the urban area in the CoT. These areas, where the immigrants tend to reside are called informal settlements, which are very densely populated within the urban environment. Informal settlements (squatter camps which means illegal settlement) are unsafe to settle-in and the material used in the construction of the houses/dwelling (wood, plastic, cardboard) is deemed to be a high fire risk (CoT, 2007).

According to CoT (2005), disaster risk reduction programs are perceived to be lacking in most of the informal settlement areas of Tshwane. The risk reduction approaches which are needed to overcome the non-implementation of risk reduction programs could be addressed with the development of a hazard and vulnerability risk profile. This could be achieved through the application of a more multi-sectoral and multidisciplinary approach to pro-actively deal with

disaster risk and the negative consequences of these hazards (Government gazette, 2002). Therefore; development of community-based hazards and vulnerability assessment framework would most appropriately be beneficial to this. The outcome of the framework would ensure a more holistic approach to disaster risk reduction; mainly focussed on multi-hazards and vulnerability studies from the bottom-up approach.

1.2.1. Research question

The research aims to answer the following questions:

- What is the traditional approach of disaster management?
- What is community based hazard and vulnerability assessment?
- What is the community based disaster risk management?
- What are the benefits of community based disaster risk management?
- What is the comparison of hazard and vulnerability risk assessment in traditional and community based disaster risk management?
- From previous studies done, what elements were not included that the CBDRM can include?
- How can the community-based hazard and vulnerability risk assessment be implemented?
- What measures of hazard and vulnerability can be used to reduce disaster risks in the Lusaka informal settlement?
- What are the coping strategies of local communities that the CoT has implemented?

1.3. RESEARCH HYPOTHESIS

The research hypothesis is that the participation and involvement of the community in risk assessment process can reduce hazards and vulnerabilities associated within Lusaka informal settlement community and other related or with similar characteristics communities within the CoT, and that this research will create the right platform for the community of Lusaka informal settlement to build its own resilience.

1.4. AIMS AND OBJECTIVES OF THE STUDY

The study focuses on an explorative and descriptive objective research as it seeks to explore risk profile of Lusaka informal settlement through community participation. The aim of this

research is to conduct a hazard and vulnerability study using community-based approach in Lusaka informal settlement within the CoT.

The main objective of the research is to gather all available information on identified hazards and the assessment of the community vulnerabilities and its capacity to cope or deal with these hazards in Lusaka informal settlement and to use this information to perform a hazard and vulnerability assessment and the development of community based disaster risk management framework using the community approach.

The specific objectives of the research are:

- To determine what community based disaster management is;
- To compare the traditional and CBDRM approach in conducting hazard and vulnerability assessments;
- To determine and explore the advantages of community based disaster risk management;
- To describe and explore the importance of community-based disaster risk management and hazard & vulnerability risk assessment;
- To explore the coping strategies and risk reduction measures implemented in Lusaka?
- To make the results of the research available to the CoT so that existing strategies and implementation measures may be assessed and/modified/or re-inforced;
- Recommendations on the implementation of community-based disaster risk management approach in Lusaka.

1.5. RESEARCH METHODOLOGY AND LITERATURE STUDY

This chapter provides insight on how the research was conducted. It provides discussion for research design, literature study, methods of data collection and analysis, and time schedule of the research project.

1.5.1. Research Design

A qualitative research design approach was used in the study. This involved a direct assessment of the experience of living in an informal settlement. The researcher collected raw data directly from the community based organisations with the assistance from the community members (Leedy and Ormrod, 2001).

A sample of residents was selected randomly to include different areas in the study area. A total sample size was 80 residents (but only 76 residents completed the questionnaires); with a mean of 20 people per each selected area.

1.5.2. Literature study

In the literature study, the theory behind the concept of a community-based disaster risk management is presented as a theoretical framework for the research. An overview of available literature on community-based disaster risk management is presented, and it includes a conceptual framework of risk, hazard and vulnerability assessment and how these can improve community preparedness measures to achieve effective disaster risk-reduction. The discussion is presented continuously through the interpretation of details from the literature that pertains to the theoretical framework relevant to the research theme.

1.5.3. Data Collection and Analysis

Data collection during the project mainly focused on the following aspects:

- A formal review of literature pertaining to all the applicable documented data included in scientific reports or publications, policy documentation and legislation.
- Statistical data collection and review regarding population demographics, which could confirm the hazards and vulnerabilities in the study;
- Data on hazards and vulnerabilities that are applicable to the disaster risks in the study area and areas with similar characteristics; and
- Semi-structured interviews were held with a representative sample of community and also disaster management practitioners interviewed.
- Focus group discussion with key community members (ward councilor and ward committee members) and the officials of the CoT disaster management were conducted and a follow-up there after to ensure the correct information was given.

For conducting fieldwork, the settlement was divided into four (4) blocks, and each block was allocated three fieldworkers. Participants in this study were selected on the basis of their acknowledged residence status in Lusaka informal settlement, upon consultation with the local leadership structure (ward committees, councillors and community members).

The main method applied in this study was by means of twelve (12) fieldworkers (volunteers from NGO's and the ward committee members), all residing in Lusaka settlement, were employed and trained to administer 80 questionnaires using the volunteers from the community (Annexure A, questionnaires). However, only 76 completed questionnaires were considered in the analysis since the rest were either partially completed or returned blank. These were distributed to a randomly selected population in the study area trained fieldworkers. The questionnaire was composed of a number of questions that were drawn from the review of selected literature and research findings on the community based disaster risk management, environmental and living conditions in Lusaka informal settlement and other informal settlements within the City of Tshwane (Questionnaire attached in Annexure A).

For purposes of providing data for the study, preference was given to participants who had resided in the area for a period of five (5) years or longer. Age eligibility for participation in the study was early adulthood (twenty-five to forty years of age) and middle age (those aged between forty to sixty years), irrespective of gender. The choice of this age group was motivated by the need to clarify risk perception, identification and vulnerabilities as well as capacity within the settlement. The target community/population for this study consisted of eighty (80) participants chosen in terms of the criteria described above. One (1) eligible member was interviewed per household, resulting in eighty (80) households participating in the study in the entire settlement as per the above criteria.

Owing to the size of the settlement and time limitations for the study, the twelve (12) fieldworkers trained in the content of disaster management and the research questionnaires and its administration, worked in accordance within the three-week schedule as depicted in Table 1 below:

Table 1*:* Time schedule for data collection.

Day 1	Day 2 and Day 3	Day 4
Four-hour meeting with volunteers/fieldworkers and training, piloting and completion of questionnaires.	Six-hours of house-to-house interviews for the completion of questionnaires. Debriefing with the	Three-hour discussion of the completed questionnaires with the field workers and ward committee members. Meeting with officials working

Another meeting with Ward Councillor Mogaladi and the ward committee members.	volunteers from the community in different sections of the ward, and members of ward committee.	for the CoT Disaster Management Centre as ell as the Ward clr. and committee members.

1.6. VALUE OF THE RESEARCH

This is a model for compiling community-based disaster management framework was established where standard guidelines were set by which City of Tshwane will be able to compile their disaster risk assessment and risk profile for informal settlements within the City of Tshwane boundary. In turn, this framework will serve as a proactive measure to a disaster and will in turn ensure the protection of the community. Through the literature review and control of existing research, this research determined the extent of planning for the community of Lusaka within the CoT.

By conducting this research, a community based hazard and vulnerability assessment study in Lusaka informal settlement will be conducted and the development of the community based hazard and vulnerability assessment framework. If the community could successfully participate in this research, this could lead to the reduction of the hazard risks and vulnerabilities identified and could also build towards the development of prevention and mitigation measures as per the IDP and the CoT disaster management plan. Stakeholders that could benefit from the development of CBDRM framework and recommendations, as contained in this research, will be Housing department, Working on Fire, Social development, department of Health, COT departments of Water and Sanitation, Environmental Management, Road storm and Water and the community of Lusaka.

1.7. STRUCURE OF THE THESIS

Chapter two mainly explores the theoretical framework of community-based disaster risk management. The discussion is initiated by highlighting the approaches of community-based disaster risk management (CBDRM), its features and characteristics. The policy and legislation and theoretical framework in community-based disaster risk management contexts relevant to the study are presented. The approach, components and purpose in conducting the hazard and

vulnerability assessment, is discussed in detail. This chapter is the core theory and background of the CBDRM and also on what other researchers are saying regarding CBDRM.

Chapter three discusses the research methodology and data collection. Data collection and research methodology and research design which include semi-structured interviews and focus group interview discussion is presented. The study area including risk profile is also eluded.

Chapter four is based on data analysis for the study area. The analysis is based on the demography of the study area questions, the educational background, the capacity assessment, community-based disaster risk management questions and the open questions for the disaster management officials.

Chapter five entails the results, interpretation and discussion of results. This chapter focuses on questionnaires respondents' interviews and discusses the answers to the interview questions that were specifically designed to address the objectives of the research. The questionnaires will be discussed and analyzed as per the respondents. The application of the progression of vulnerability is used to assist in plotting out the root causes and the unsafe conditions for the community of Lusaka settlement is also discussed in this chapter.

Chapter six will highlight the development of community-based hazard and vulnerability assessment framework. This chapter discusses the solutions to the problems identified in chapter four through the application of the progression of vulnerability model and progression of safety will be utilized to set the foundation for the development of a community-based hazard and vulnerability framework within the CoT as well as the solution to the problems of Lusaka settlement. The chapter further elaborates more on the views of the community-based disaster risk management approach to the study area. This is done by addressing the views of the CBDRM from other authors, corrective measures of the CBDRM, and the risk reduction strategies as highlighted in chapter two.

Chapter seven involves the conclusions and recommendations of the research. It also highlights the policy implications of the proposed strategies and future research needs as well as the suggested framework.

1.8. SUMMARY

In summary the fore-going chapter indicates the premises behind conducting a community-based hazard and vulnerability assessment to the community of Lusaka settlement in the CoT. This is done logically and begins by introducing the background to the study, the problem statement and research questions are presented, the aims and objectives of the study are outlined, the study area is defined, the research design and methods of data collection is discussed, and the value of research topic, and structure of the thesis is provided.

This focuses on a case study in the Lusaka informal settlement in CoT. The possibilities and constraints of the community-based disaster risk management approach to assess hazards and vulnerabilities at different scales under the specific conditions of the case study is the central topic of this research. The concepts of disaster-related hazards and vulnerabilities often gains high attention and strong discussion among different scientific disciplines, whereas practitioners try to develop and implement suitable methodologies. Participatory approaches are also evolving as a result of the failure of different top-down development/traditional approaches in the last decades. According to the researcher, this approach would benefit the community of Lusaka informal settlement and can be adapted to other similar informal settlement within the CoT.

CHAPTER TWO:

COMMUNITY BASED DISASTER RISK MANAGEMENT: A THEORETICAL OVERVIEW

2.1. INTRODUCTION

"The identification or service targeting of potentially at-risk community does not necessarily make them helpless individuals. Nevertheless, this community should be considered because they are at a greater likelihood of being at risk (Pearce, 2000)".

Disaster risk unfolds over time through the concentration of people and economic activities in areas exposed to hazards, e.g. floods and structural (shack) and veld fires, through the frequency and magnitude of hazards events and through the vulnerability of the communities and economies, understood in terms of lack of capacity to absorb and recover from hazard impacts (UN, 2007). Risk becomes manifest when disasters occur but often is invisible to those taking development decisions at all levels. Risk reduction begins with risk identification and assessment, including early warning systems. However, the practice of risk identification is limited in Africa. Sub-regional early warning systems covering food security, drought and climatic factors exist in parts of Africa but desertification monitoring systems are only now being developed. A few countries have completed vulnerability and capacity assessments but these were to support food assistance and social protection management (Pearce, 2000).

Each community has a way in which its members organize themselves and rules exist to ensure the normal functioning and protection of its members and their activities. Examples are locking of doors, fences, time frames for washing, noise management etc (ADPC, 2002).

They may not be scientific but the richness of experience and indigenous knowledge is a resource to be recognized. In many cases, people learn that with proper training and information the communities are able to safeguard and minimize the disaster risks. It is essential that local capacities be strengthened to assess risks and develop mitigation strategies that are based on the communities' human, financial, information and material resources (ADPC, 2000). The realization of the importance of the active involvement of the community itself became evident in the South African National Disaster Management Framework (Government gazette, 2005) which stated: "The community is at the coalface of disaster

management. It is from the conditions of risk that exist in communities that all other disaster management activities evolve. It is the community where all the operational activities related to disaster management take place. All risk reduction planning, the development of projects and programmes and the allocation of responsibilities must be founded on the needs and priorities of communities (Government gazettes, 2005).

During 2007, the CoT undertook a process of macro risk assessment to serve as a foundation for the development of strategies to deal with particular emergencies, for allocating resources and for helping to set priorities and standards in ensuring the safety of the community. This process culminated in the adoption of the Vulnerability Analysis and the development risk atlas for the CoT (2007). In its Vulnerability Analysis (CoT, 2007), the CoT noted that a variety of natural, environmental, technological and political hazards regularly threaten the welfare of residents of the CoT. Thus, the vulnerability assessment could not reach the community risk reduction strategies and coping measures during disasters and this leads to the delay of CoT to develop risk reduction strategies for the community.

The research further points out that as the cities continue to grow, development patterns alters the land's ability to recover from disastrous natural events, and the compilers recommend that a community-centred approach is essential in the management of these risks and the formulation of local, integrated plans and programs (CoT, 2007). This approach fits in with the City of Tshwane Integrated Development Programme (IDP) (CoT, 2005). It is therefore important to identify hazard risks and vulnerabilities for the community of Lusaka informal settlement in order to introduce preventative and preparedness measures to ensure that any foreseeable impacts of developments on the community are limited as much as possible. From the research perspective, the chapter entails a background and theoretical framework on community based disaster risk management as well as the progression of vulnerability model.

Furthermore this chapter also attempts to illustrate how the Pressure and Release (PAR) model will determine the "Progression of Vulnerability" (Wisner *et al*. 2003), as caused by the increased hazards and the community vulnerability in the Lusaka informal settlement. The chapter concludes by indicating policies and legislative requirements of community-based disaster risk assessment and approach in South Africa and the community based disaster risk management as background theory.

2.2. THEORETICAL FRAMEWORK OF COMMUNITY-BASED DISASTER RISK MANAGEMENT

"The local community is taken as the primary focus of attention (in disaster reduction) since that is the common unit which is affected by disaster and, more importantly, responds to deal with the event" (Kotze and Holloway, 1996).

A theoretical framework is a field of reference within which the research places the theme of the study in order to clarify the context within which it originates. Accordingly, this chapter presents the theoretical paradigm relevant to the research (ADPC, 2002). Twigg (2004) makes a valuable contribution to risk reduction measures in urban areas by distinguishing between "private" and "public" spaces. According to Twigg (2004), urban residents may be willing to participate in risk reduction activities to protect their own homes, but may feel that "public space" like drains, roads etc. is the responsibility of the local government. The attitude and view of the community with regards to local government responsibility can therefore hamper or enhance community involvement in risk reduction activities (Twigg, 2004).

Apart from the possibilities that urban areas present better jobs and outcomes for the millions of poor living in the developing areas of the world, urban areas have always been regarded as a means to improve their environment and quality of life (Twigg, 2004). Deteriorating conditions in the rural areas have in the last three decades in particular generated a considerable flow of migrants to the cities. The priorities of the urban migrants change over time, depending on the conditions that they find themselves in. According to Twigg (2004), one of the first dilemmas that they face and that persist for a long period of time is the question of adequate housing. With limited financial resources and skills, the drastic option of illegally occupying a vacant piece of land to build a rudimentary shelter, is generally the only one available to them (Huchzermeyer, 2001).

2.2.1. What is community-based disaster risk management

Before going further, it is necessary to make clear what is meant by disaster management and community-based disaster management and why it is necessary. When the question is asked "What is a disaster?" the image of a flood, cyclones, and the associated effects, loss and damage comes out. When people ask themselves "Who works in disasters?" they tend to think of the fire brigade, ambulance, rescue workers, and so on. People tend to associate disasters

with emergencies and disaster management with emergency response (Yodmani, 2001). Community-based disaster risk management can be seen as risk reduction programs designed primarily by and for the people in certain disaster-prone areas. Disaster mitigation using government and institutional interventions alone is insufficient because they pay little attention to addressing the community dynamics, perceptions and/or priorities. At the same time, local communities are often either unaware of these formal disaster management interventions or they find the interventions inappropriate due to the lack of recognition of community's vulnerabilities and capacities, or they lack the external resources or technical support to supplement their own initiatives and capacity (Yodmani, 2001).

Just as every individual, family, organization, business and public service within a community will be affected by a disaster, each has a role to play in managing that disaster. Looking at it practically, the multitude of actions that must be taken to implement an effective disaster management program requires the participation of the entire community. Another reason for implementing community-based approaches is that communities are knowledgeable about the disasters happening in their environment and are able to anticipate them in some cases. It may not be scientific in nature, but the richness of experience and indigenous knowledge is a resource to be recognized (Yodmani, 2001).

Disaster risk in this regard can be fined as:

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community/society to cope using its own resources. It is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

The term can be formulated as: disaster risk = $\frac{H \times V}{C}$

Where H is Hazard, V is Vulnerability and C is Capacity

In one way or another in any community disaster risks are always present. The possibility that a disaster might or might not occur will depend on whether those risks are adequately managed or not. Looking at disasters from this perspective the management of the emergencies ceases to be a priority. The priority becomes the management of those risks, because if they are managed ineffectively, it can lead to disaster (Yodmani, 2001). According to the (ADPC, 2001),

the community should be able to directly gain resulting from improved disaster risk management. This in turn will contribute to a progression towards safer conditions, security of livelihood and sustainable development. This underlines the point that the community is not only the primary actor but also the beneficiary of the risk reduction and development process.

The table below presents a comparison of traditional and CBDRM approaches in disaster management.

Table 2: Comparison of traditional and community based disaster risk management.

Traditional Approach	CBDRM Approach
Disasters are unforeseen events that cannot be prevented.	Disasters can be prevented. Community can be prepared to avoid and reduce damage and loss.
Stress is on emergency response and recovery.	Stress is on disaster risk management activities before the disaster, on prevention, mitigation and preparedness.
People affected by disasters are helpless victims and passive recipients of external aid.	People affected by disasters are active participants in rebuilding their life and livelihood. People's existing capacities are used and strengthened.
Program stuff	Community residents
Extensive services	Community organizations
Dependency creating	Empowering
Top-down	Bottom-up
Institution/organization	Community

Source: APDC, 2002

Community based disaster risk management (CBDRM) is anchored in the disaster risk reduction framework. CBDRM covers a broad range of interventions, measures, activities, projects and programs to reduce disaster risks which are primarily designed by people in at-risk localities and are based on their urgent needs and capacities (Twigg *et al*, 2000). Through CBDRM, vulnerable groups and communities can be transformed to disaster resilient communities which can withstand and recover from stresses and shocks from the natural/physical and socio-economic political or environment (Twigg *et al*, 2000). To enrich the community's involvement in risk reduction it is important to first assess the risk with the help of

the community. While it is clear that the poor are often the most affected in a disaster, it is too simplistic to assume that there is a direct and absolute correlation between poverty and vulnerability. Cannon (1994) points out that "it may be true that most of the suffering in disasters is experienced by poor people, it may not be the case that all poor suffer. Poverty, as an indicator of lack of access to resources and income opportunities, is only *one* of the several dimensions of vulnerability.

To create an academic context for the study, “Community-Based Disaster Risk Management (CBDRM)” has been identified as the appropriate theoretical framework for the research and also for the City of Tshwane to reduce hazards and vulnerability of the community, and thereby building a resilient community in Lusaka informal settlement and other related informal settlements within the CoT. Only local people know their own needs and therefore only they can define their own priorities for mitigation, within a given context (Bollin, 2003).

2.2.2. Steps of community-based disaster risk management

The steps of community based disaster risk management are as follows:

1) Initiating the process - linkage and building rapport with community
2) Community Profiling - initial understanding of disaster situation and orientation on CBDM;
3) Community Risk Assessment – participatory assessment of hazards, vulnerabilities, capacities and people’s perception of risks;
4) Formulation of Initial Disaster Risk Reduction Plan - identification of appropriate mitigation and preparedness measures including public awareness, training and education;
5) Formation of Community disaster response organization - community organizing and mobilization, capability building in mitigation and preparedness;
6) Implementation of short-, medium-, and long-term risk reduction measures, activities, projects and programs - implementation strategies and mechanisms; Organizational/institutional strengthening;
7) Monitoring and Evaluation - continuous improvement of disaster risk reduction plan, documentation and dissemination of good practices for replication.

Disaster risk management ward committee and disaster response organization are the necessary interface or the channel for outsiders such as NGOs or government agencies to

assist/support the community at-large. The community groups and organizations in disaster risk management are essential in sustaining the risk reduction process for the community to meet intended aims and targets (Bollin, 2003).

During the CBDRM process, it is important to develop and enhance the collaborative mechanism between the local authorities, the local communities and other stakeholders, and to build up the vulnerability reduction measures while capitalizing on the already existing indigenous capacity and wisdoms of the local community. Disaster risk is driven by a combination of hazard and vulnerability processes, including changing patterns of land use, infrastructure development/maintenance, urban growth and settlement densification. Similarly, household size and composition, health status and level of livelihood security affect household potential for disaster-related loss. Some disaster risks, particularly those triggered by climate processes, must be reviewed seasonally prior to the rainy season or hot summer months (Government gazette, 2005).

2.2.3. Characteristics of community based disaster risk management

The implementation of Community Based Disaster Risk Management points to the following essential features (Bollin, 2003):

- The community has a central role to play in long term and short term disaster management. The focus of attention in disaster management must be the local community;
- Vulnerability reduction is the foundation of CBDRM. The primary content of disaster management activities revolves around reducing vulnerable conditions and the root causes of that vulnerability. The primary strategy of vulnerability reduction is the increasing of a community's capacities, their resources and coping strategies;
- Linkage to the development process. Disasters are viewed as unmanaged development risks and unresolved problems of the development process (Bollin, 2003). CBDRM should lead to a general improvement of the quality of life of the vast majority of the poor people and of the natural environment;
- Community as a key resource in disaster risk reduction. The community is the key actor as well as the primary beneficiary of disaster risk reduction. Within the community, priority attention is given to the conditions of the most vulnerable as well as to their mobilization in the disaster risk reduction. The community participates in the

whole process of disaster risk management from situational analysis to planning to implementation (Reid, 2000);

- Application of multi sectoral and multi disciplinary approaches. CBDRM brings together the multitude of community stakeholders for disaster risk reduction to expand its resource base. The local community level links up with the intermediate and national and even up to the international level to address the complexity of vulnerability issues. A wide range of approaches to disaster risk reduction is employed in this approach (Reid, 2000); and
- CBDRM as an involving and dynamic framework. Lessons learned from practice continue to build into the theory of CBDRM to improve future studies. The sharing of experiences, methodologies and tools by communities and CBDRM practitioners continues to enrich practice (Reid, 2002).

2.3. UNDERSTANDING THE COMMUNITY-BASED RISK MANAGEMENT

According to the ISDR (2005) a community can be defined geographically; such as a cluster of households, a small village, or a neighbourhood in a town. A community can also be defined by shared experience, such as particular interest groups, ethnic groups, professional groups, language groups, particular hazard-exposed groups, etc. Community can be defined by sector, such as the farmers, fisher folk, business sector, etc. Community can be used to refer to groupings that are both affected by and can assist in the mitigation of hazards and reduction of vulnerabilities (ISDR, 2005).

According to Bollin (2003), the term 'community-based disaster risk management' stresses the special role attached to the local level of municipal administration as the interface with the necessary legal powers (above all land use and settlement planning, declaration of state of emergency). The municipality also bears responsibility for assimilating disaster risk management firmly in long-term community development (development plans) (CoT, 2007).

The successful introduction of community-based disaster risk management depends heavily on local general conditions such as personal or party-political rivalry, personnel turnover or the occurrence or non-occurrence of extreme natural events. Conflicts can, however, often be averted with the help of information exchange, transparency and integration (Bollin, 2003). Due to the high personnel and time input required, the large differences in local risk profiles and the

various general conditions are an impediment to the independent transfer of the approach by national institutions, which mostly lack the requisite re-sources and capacities (Bollin, 2003). The influence of participatory ideas and approaches should not be exaggerated. They have extended their influence rapidly since the early 1980s, but the prevailing approach to development and disaster management remains a top-down one. People in positions of power, be it political, institutional or professional, are reluctant to hand over authority to the grass roots. Many organisations have called their work 'participatory' but have not changed the substance of their approach (Twigg, 2001).

The City of Tshwane must begin to introduce community-based disaster risk management to local communities within the CoT. The new experience under changed conditions will contribute to the ongoing development of strategies and instruments, which necessarily won't bring any positive impact unless the community is encouraged to participate in all the development planning and decision making.

2.3.1. Views on community-based disaster risk management

The realization of the importance of the active involvement of the community itself became evident in the SA National Disaster Management Framework (Government gazette, 2005) which stated: "The community is at the coalface of disaster management (Government gazette, 2005). It is from the conditions of risk that exist in communities that all other disaster management activities evolve. It is the community where all the operational activities related to disaster management take place. All risk reduction planning, the development of projects and programmes and the allocation of responsibilities must be founded on the needs and priorities of communities. According to the Government gazette (2005), risk reduction is a community-driven process.

CBDRM is an essential precursor to a bottom up decision making process for development policies, strategies, plans, programs and projects in disaster risk reduction (ADPC, 2003). Community based hazard and vulnerability assessment provides the community and support agencies with disaster risk specific baseline data that can be integrated in a situational analysis for development planning and decision making. Furthermore, it provides the community and support agencies with baseline data which is useful in doing the 'damage, needs, capacities assessment' of the community for emergency response purposes (Bollin, 2003).

According to Van Elst & Swart (1998) it further transpired that South Africa failed to keep pace with the latest developments in the disaster management field as a result of international isolation and a lack of exposure. A number of international events have an important bearing on the approaches and thinking that should inform disaster management policy in South Africa. In 1989 the United Nations General Assembly declared the decade between 1990 and 1999 as the international Decade for Natural Disaster Reduction. This declaration was a clear call for greater disaster prevention, mitigation and preparedness (Government gazette, 1998).

2.3.2.. The Bottom-Up approach

In addition to the focus on disaster risk management, there is another growing trend taking place: the shift from a top-down to a bottom-up approach. This is due to, on one hand, communities starting to play a much stronger role in disaster risk management to reduce risk. On the other hand, aid and development agencies are finding new approaches to disaster management that attempt to merge the disaster risk reduction strategies defined by policymakers with the needs and resources of the local community, where eventually the success and failure of disaster management activities will be tested (Yodmani, 2001). CBDRM is an approach that relies on the capacity of the community to remedy their disaster risk situation themselves and to help each other (Heijmans & Victoria, 2002).

There is growing evidence to show that most top-down disaster risk management and response programs (traditional approach) fails to address specific local needs of vulnerable communities (Lusaka informal settlement), ignore the potential of local resources and capacities, and may in some cases even increase people's vulnerability (ADPC, 2003). According to the ADPC (2002), the multitude of actions that must be taken to implement an effective disaster management program requires the participation of the entire community. Another reason for implementing community-based approaches is that communities are knowledgeable about the disasters happening in their environment and are able to anticipate them in some cases (Reid, 2000).

Over the last two decades there has been a growing realization that disaster risk management is most effective at the community level where specific local needs, resources and capacities are met. It is at the local level that the physical, economic and social risks faced by the poor can be adequately assessed and managed. Some initiatives in this direction have come up in recent years in the global arena (APDC, 2001).

There is growing evidence to show that most top-down disaster risk management and response programs fail to address specific local needs of vulnerable communities, ignore the potential of local resources and capacities, and may in some cases even increase people's vulnerability (ADPC, 2003). As a result, a broad consensus has been reached among disaster risk management practitioners to put more emphasis on community-based disaster risk management programs. This means the vulnerable people themselves will be involved in planning and implementing disaster risk management measures along with local, provincial, and national entities through partnership (ADPC, 2003).

2.4. COMMUNITY BASED DISASTER RISK MANAGEMENT PROCESS

Community-based hazard and vulnerability assessment (CBDRM) as a framework focuses on reducing threats and potential losses. The research will also contribute to the INTERNATIONAL STRATEGY FOR DISASTER REDUCTION (ISDR) aim of developing a "culture of safety" and creating "disaster resilient communities" and it is also in line with the 'Safer City policy' (ISDR, 2002). '(CBDRM) is a process in which at-risk communities are actively engaged in the identification, analysis, treatment, monitoring and evaluation of disaster risks in order to reduce their vulnerabilities and enhance their capacities' (Abarquez & Murshed 2004).

This means that people at the heart of decision making and implementation of disaster risk management activities. The involvement of most vulnerable social groups is considered to be of paramount importance in this process, while the support of the least vulnerable groups to them is necessary for successful implementation of these strategies. Where other disaster risk management processes and practices exclude those who are at risk or potentially at risk, CBDRM puts at risk communities at the heart of the entire disaster risk management process. Where other risk assessments stop at the determination of whether an undesirable event will occur, CBDRM moves on to the determination of people's capacities and encourage the use of individual and community resources to reduce disaster risks that affect their lives. This is founded on the belief that local people can and will help themselves to prevent or reduce disaster risks (ISDR, 2002). In evaluating disaster risk, the social factors of vulnerability needs to be considered with at least the same degree of importance that is devoted to understanding and addressing natural hazards. Expressed schematically, our view is that the risk faced by people must be seen as a cross-cutting combination of vulnerability and hazard (Heijmans,

2001). Disasters are a result of the interaction of both; there cannot be a disaster if there are hazards but vulnerability is (theoretically) nil, or if there is a vulnerable community but no hazard event (Heijmans, 2001).

The hazard and vulnerability assessments have been successfully carried out and hazards identified and vulnerabilities assessed. The findings of this study will help to improve the mitigation strategies and preventative measures of reducing the impact of the disasters. The community is assessed for its vulnerability to various hazards and the progression of safety model will provide solutions to address the identified hazards (Twigg, 2004).

The employment of the concept of vulnerability as a tool in and by the community also involves a thorough analysis with and by the residents of their own resources and capacities. It is in the hands of local people that the logic of their situation, the phenomenology of their living with risks, forces them to be aware of and to discuss their strengths and capacities, as well as their weaknesses and needs (Wisner 1988; Anderson and Woodrow 1998). Below here (figure 2) is a model of community based disaster risk management process. The goal of CBDRM which forms part of the research is to transform the at-risk communities to disaster resilient communities. The general process of CBDRM is as follows (Victoria 2002):

1. Rapport building with community
2. Community profiling
3. Community risk assessment
4. Formulation of initial disaster risk reduction plan
5. Formation of community disaster response organization
6. Implementation of reduction measures and
7. Monitoring and evaluation.

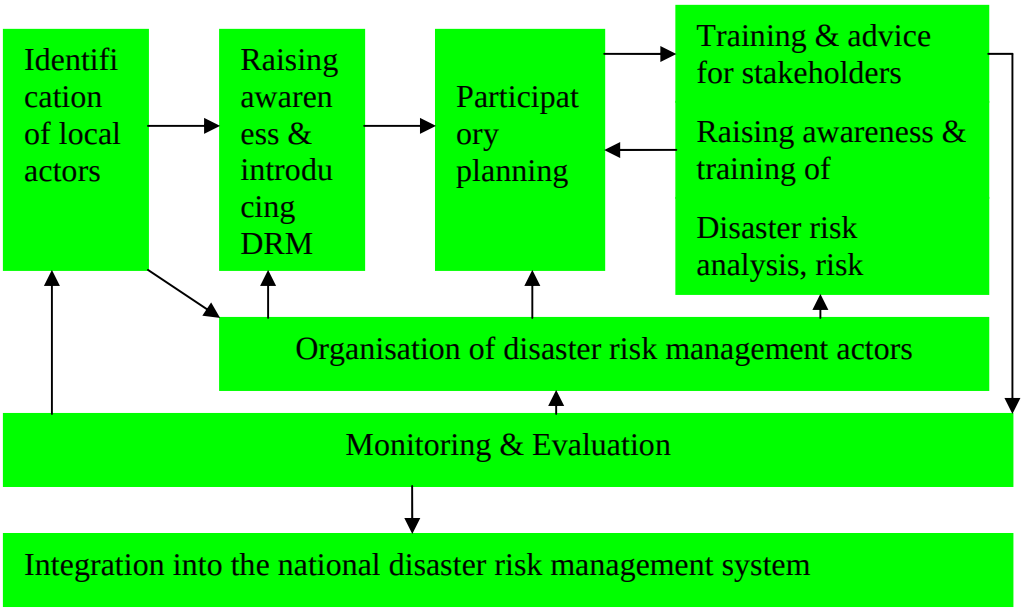


Figure 2: Process of community-based disaster risk management

Source: Bollin, 2003

Figure 2 above shows the process of introducing community-based disaster risk management. It only provides a rough chronological guide, however, because new major actors may be identified, briefed and brought in during planning and implementation activities, for in-stance. This process fits very well with the study in terms of implementation phase towards building a resilient community.

According to Bollin (2003), there are arguments in favour of all these approaches and they can help establish disaster risk management in the municipalities, so there is no need to set priorities. In general it is an advantage if there is a demand in the municipality. This will also help facilitates implementation and increases the chances of the community actually identifying with the process and seeing it as its own contribution.

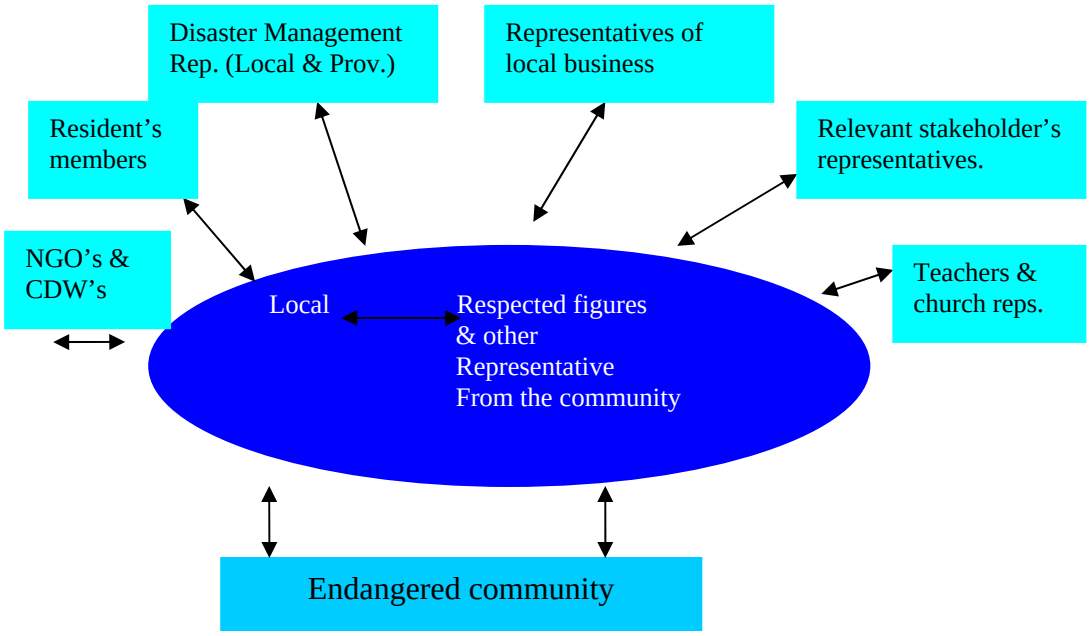


Figure 3: Relevant actors in disaster risk management at local level

Source: Yodmani, 2001

The role the municipal authority (Disaster Management Centre) can vary from passive assistance to active collaboration to taking initiatives. It is important that it is informed about community disaster risk management activities, approves of them and includes them in its own planning. The more actively a municipality supports community based disaster risk management, the more effective it can be, because:

- many risk reducing measures such as settlement and land use planning, the zoning and equipment of emergency accommodation or adequate waste disposal and sanitation need its backing and active assistance;
- Disaster risk management centre should be an integral component of local development policy; the responsible and official democratically-elected coordination body of the different sectors for this is the CoT.

Efforts by CoT to implement disaster risk management alone can, how-ever, only lead to limited success; a broad effect can only be achieved with the participation of the community at risk. The first practical connection is made via the participation of respected (figure 2 & 3 above) and other representatives of the population, who:

- channel the interests and knowledge of the community into disaster risk management;
- CoT Disaster Management can educate the community on the need for and opportunities afforded by disaster risk management and motivate them to cooperate and change their minds and behaviour;

- Greatly enlarge the operational scope of the community-disaster risk management approach through their voluntary input.

2.5. COMMUNITY BASED DISASTER RISK ASSESSMENT

Community-based disaster risk assessment is a participatory process of determining the nature, scope and magnitude of negative effects of hazards to the community and its households within an anticipated time period. It determines the probable or likely negative effect (damage and loss) on 'elements at risk' (people - lives and health; household and community structures, facilities and services – (houses, schools, hospitals, etc.); livelihood and economic activities (jobs, equipment, crops, livestock, etc.); lifelines – (access roads and bridges) (ADPC, 2000). Community participation and involvement in hazard and vulnerability assessment is essential in the development process because of the following practical considerations (Reid. 2000):

- Nobody can understand local opportunities and constraints better than the local communities themselves who therefore need to be involved in the identification and resolution of disaster vulnerability issues.
- Nobody is more interested in understanding local affairs than the community whose survival and well-being is at stake.
- Therefore the information should be generated in a manner and language that is understood by the community.

The coping mechanisms and the resources (capacities) present in the community are also essential considerations in community based disaster risk assessment. Participation of community members is an essential component of community based risk assessment which determines the methodologies and tools used (ADPC, 2000).

For the purpose of this study, community based disaster risk assessment will be defined as a participatory process to identify and assess the hazards that threaten the community and the community's vulnerabilities and capacities (ADPC, 2000). This involves an understanding of how people in the community perceive and measure disaster risk. It also involves analysis of past patterns of hazards and present threats at the community level (hazard assessment), combined with an understanding of the underlying causes of why hazards become disasters (vulnerability assessment) and of the available resources an affected community uses or can

use to reduce risk (capacity assessment), and how different people perceive and measure risk (Bolin, 2003).

2.5.1. Components of community based disaster risk assessment

Community based disaster risk assessment has four main inter-related steps. These are:

- *Hazard assessment*: determines the likelihood of experiencing any natural or human-made hazard or threat in the community. Assessment includes the nature and behaviour of each of the hazards the community is exposed to.
- *Vulnerability assessment*: identifies what elements are at risk and why they are at risk (unsafe conditions resulting from dynamic pressures which are consequences of root or underlying causes).
- *Capacities assessment*: identifies the people's coping strategies; resources available for preparedness, mitigation and emergency response; who has access to and control over these resources.

Alexander (2000) distinguished between risk and vulnerability, noting that 'vulnerability refers to the potential for casualty, destruction, damage, disruption or other form of loss in a particular element: risk combines this with the probable level of loss to be expected from a predictable magnitude of hazard.

2.5.2. Purpose of Community based disaster risk assessment

Community based hazard and vulnerability assessment provides the community and support agencies with disaster risk specific baseline data that can be integrated in a situational analysis for development planning purposes. Furthermore, it provides the community and support agencies with baseline data which is useful in doing the 'damage, needs, capacities assessment' of the community for emergency response purposes (Davis & Hall, 1999).

According to (Davis & Hall, 1999), such approach (community based hazard and vulnerability risk assessment) is based on the idea that communities know their own situations best and that any analysis should be built on their knowledge of local conditions. Ideally, they should also empower communities to take charge of their own efforts to identify and address vulnerability, and enable them to find opportunities to enhance their resilience to natural hazards. As mentioned earlier, evidence on the number and type of initiatives such as the one described above is less extensive, as are their exact outcomes and results. The pressure and release

model (progression of vulnerability) will be used to assist in identifying the root causes of the communities' vulnerability.

2.6. PRESSURE AND RELEASE MODEL: PROGRESSION OF VULNERABILITY

The Pressure and Release (PAR) model, which was developed by Blaikie, Cannon, Davis and Wisner in the mid 1990's, provides a basic analysis of vulnerability in relation to specific hazards. This model links the dynamic processes at different scales and different access to resource profiles, with vulnerability conditions (UNDP, 2002). The PAR model as illustrated in (Figure 2) resembles a nutcracker, with increasing pressure on people arising from either side from their vulnerability, and from the impact (and severity) of the hazard for those people. The 'release' idea is incorporated to conceptualize the reduction of a disaster and to relieve the pressure, vulnerability has to be reduced (Wisner, 2003). The United Nations Disaster Management Training Program (UNDMTP, 1992) defines the elements of the above-mentioned progression of vulnerability as follows:

- Underlying causes: a deep-rooted set of factors within a society that together form and maintains vulnerability.
- Dynamic pressures: a translating process that channels the effect of negative cause into unsafe conditions; this process may be due to a lack of basic services or provisions; it may result from a series of macro-forces.
- Unsafe conditions: the vulnerable context where people and property are exposed to the risk of disasters; the fragile physical environment is one element; other factors include an unstable economy and low-income levels (UNDMTP, 1992).

The Pressure and Release model (PAR model) is introduced in this research as a simple tool and part of the research project for showing how disasters occur when natural hazards affect vulnerable people. Their vulnerability is rooted in social processes and underlying causes which may ultimately be quite remote from the disaster event itself (Blaikie *et al*. 2004). Over the four decades from the 1960s to the 1990s, there was an exponential increase in human and material losses from disaster events, though there was no clear evidence that the frequency of extreme hazard events had increased. This indicated that the rise in disasters and their consequences was related to the rise in the vulnerability of people all over the world that was induced by the human determined path of development. Noteworthy also was the recognition that this increase in vulnerability was not uniform (Wisner, 2003).

From this realization that people's vulnerability is a key factor determining the impact of disasters on them, emphasis shifted to using "vulnerability analysis" as a tool in disaster risk management (Yodmani, 2001). The basis for the PAR idea is that a disaster is the intersection of two opposing forces: those processes generating vulnerability on one side, and the natural hazard event (or sometimes a slowly unfolding natural process) on the other (Blaikie *et al.* 2004). The image resembles a nutcracker, with increasing pressure on people arising from either side – from their vulnerability and from the impact and severity of the hazard for those people. According to Blaikie *et al* (2004) the 'release' idea is incorporated to conceptualise the reduction of disaster: to relieve the pressure, vulnerability has to be reduced (Blaikie *et al.* 2004).

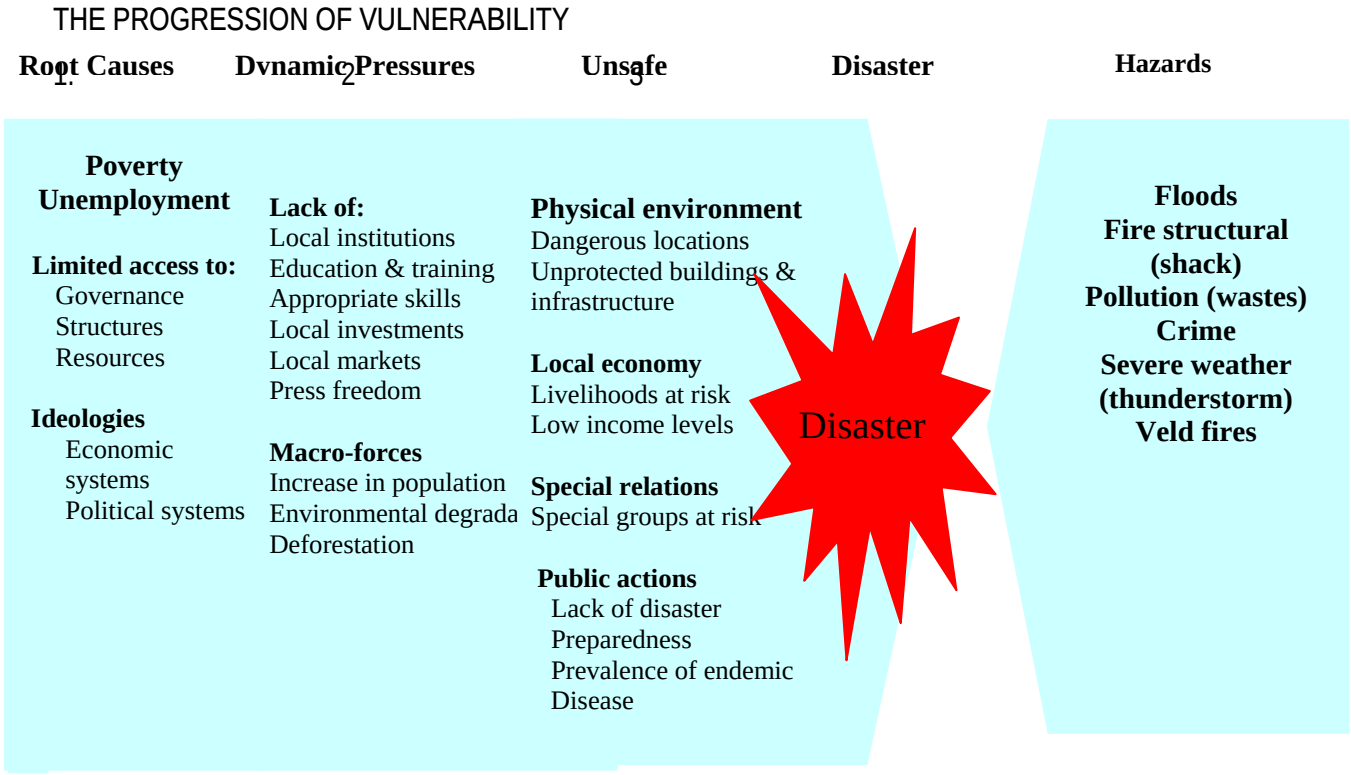


Figure 4. Progression of Vulnerability

Source: Blaikie et al., 2004

2.6.1. Cause and effect in the Disaster Pressure model

Figure 2 above illustrates the PAR model, and is based on the idea that an explanation of disasters requires the research to trace the connections that link the impact of a hazard on people with a series of social factors and processes that generate vulnerability (Blaikie *et al,* 2004). The explanation of vulnerability has three sets of links that connect the disaster to processes that are located at decreasing levels of specificity from the people impacted upon by

a disaster. The most distant of these are *root causes* which are an interrelated set of widespread and general processes within a society and the world economy. Blaikie *et al* (2004) highlighted that the causes and effect in disaster as 'distant' in one, two or all of the following senses: spatially distant (arising in a distant centre of economic or political power), temporally distant (in past history), and finally, distant in the sense of being so profoundly bound up with cultural assumptions, ideology, beliefs and social relations in the actual lived existence of the people concerned that they are 'invisible' and 'taken for granted' (Blaikie *et al,* 2004). While it is clear that the poor are often the most affected in a disaster, it is perhaps too simplistic to assume that there is a direct and absolute correlation between vulnerability and poverty.

APDC (2001) supported the idea that poverty, as an indicator of lack of access to resources and income opportunities, is one of the several dimensions of vulnerability. In addition to the economic dimension, there are also other aspects of social positioning such as geographical location, age, gender, class, ethnicity, community structure, community decision making processes, and political issues that determine poor people's vulnerability. Secondly though poor communities are economically vulnerable, they very often have social, cultural, and political capacities to cope with disasters, which are the greatest assets in disaster risk management (APDC, 2001).

The most important root causes that give rise to vulnerability and which reproduce vulnerability over time are economic, demographic and political processes. These affect the allocation and distribution of resources, among different groups of people. They are a function of economic, social, and political structures, and also legal definitions and enforcement of rights, gender relations and other elements of the ideological order. Root causes are also connected with the function or dysfunction of the state, and ultimately the nature of the control exercised by the police and military, and with good governance, and the rule of law (Wisner *et al*, 2003).

2.7. POLICIES AND LEGISLATIVE REQUIREMENTS

The City of Tshwane (CoT) in its Integrated Development Plan (IDP) (2005) identifies a disaster risk management policy which is founded on the following key objectives:

- Preventing and reducing risk and vulnerability;
- Mitigating disaster severity;
- Ensuring preparedness;

- Promoting rapid and effective response;
- Ensuring the provision of relief;
- Implementing rehabilitation and reconstruction measures consistently to ensure a developmental focus.

The CoT's Integrated Development Plan (CoT, 2005) states that the disaster management policy alluded to above will contribute to the implementation of the metropolitan's vision: "the leading African Capital City of Excellence that empowers the community to prosper in a safe and healthy environment". During the year 2000 cape flats floods resulted in the review of the Civil Protection Act No 67 of 1977 that was the legislative instrument for handling disasters in the country was response oriented and did not put emphasis on the prevention and mitigation of disasters (Van Elst & Swart, 1998).

The White Paper on Local Government (Government gazette, 1998) identified the need for effective disaster management resources and capacities that are to be developed by all spheres of government. Each municipality should proactively plan for the prevention and management of disasters and through planning and implementation processes, seek to minimize the vulnerability of communities and protect people who are at risk. The Act requirements for priority setting with respect to disasters likely to affect South Africa are set out in sections 20, 33 and 47. These sections underscore the importance of disaster risk assessment to guide national, provincial and municipal disaster risk reduction efforts, including disaster risk management planning (Government gazette, 2005).

Key Performance Area 2 (KPA) in the framework (Government gazette, 2005) outlines the requirements for implementing disaster risk assessment and monitoring by organs of state within all spheres of government. Furthermore, it shows that the outcomes of disaster risk assessments directly inform the development of disaster risk management plans as well as the IDP (Government gazette, 2005). The Government promulgated the Local Government: Municipal Systems Act, 32 of 2000. The scope of the Municipal Systems Act, 32 of 2000 being the giving of effect to issues of "developmental local government"; to set principals, mechanisms and processes that promote economic and social upliftment of people and communities (SALGA, 1996).

In giving effect to Section 26 (g) of the Municipal Systems Act, 32 of 2000, the Disaster Management Act, 57 of 2002 provides the framework and direction for the implementation of disaster risk management at all spheres of government and includes the need for consultation with communities and stakeholders in order to reduce disaster risk. The global review of disaster risk initiatives, living with risk, (UNDP, 2002) indicates that disaster reduction strategies demand political "statesmanship" in order to link sustainable development and local development to disaster risk reduction. In considering the above statement, politicians, communities and disaster management practitioners, in developing disaster management legislation considered and implemented the provisions of the World Conference on Natural Disaster Risk Reduction and the Yokohama Strategy and Plan of Action for a Safer World (1994). The Yokohama strategies, (Living with risk, 2002), when compared with Disaster Management Act, 57 of 2002 are incorporated in the preamble, which takes into account, the importance of risk reduction, prevention and mitigation within a sustainable development framework (Government gazette, 2002).

Such sustained, committed and concerted efforts with regard to disaster risk management reform by the government and a wide range of stakeholders were reflected in the promulgation of the Disaster Management Act, 2002 (Act No. 57 of 2002) on 15 January 2003 (Government gazette, 2002). The Act provides for:

- an integrated and co-ordinated disaster risk management policy that focuses on preventing or reducing the risk of disasters, mitigating the severity of disasters, preparedness, rapid and effective response to disasters, and post-disaster recovery;
- the establishment of national, provincial and municipal disaster management centres;
- disaster risk management volunteers;
- Matters relating to these issues.

The Act calls for ongoing research into all aspects of disaster risk reduction and management. The National Disaster Management Centre (NDMC), through a process of consultation, must develop a strategic disaster risk reduction research agenda to effectively inform disaster risk management planning and implementation in southern Africa. This research is also linked to the IDP processes of municipalities and also complies with the Act and Disaster Management Framework (Government gazette, 2005).

For the first time in South Africa (SA) a process of wide consultation on the whole approach to the management of disasters followed, culminating in 1997 with the publication of the Green Paper on Disaster Management. The Green Paper, which highlighted the need for a holistic mechanism for the management of disasters in SA, was followed in the ensuing year by the White Paper process and in January 1999, for the first time in history, SA had a national policy on the management of disasters where Disaster Management Act, Act 57 of 2002 was promulgated and in 2005, the disaster management framework was developed in order to give guidelines to all three spheres of government (Government gazette, 2005).

2.8. SUMMARY

The realization of the importance of active involvement of the community itself became evident in the South African National Disaster Management Framework stated: "The community is at the coalface of disaster management. It is from the conditions of risk that exist in communities that all other disaster management activities evolve. It is at the level of the community where all the operational activities related to disaster management take place. All risk reduction planning, the development of projects and programmes and the allocation of responsibilities must be founded on the needs and priorities of communities at risk.

CBDRM is an essential precursor to a bottom up decision making process for development of policies, strategies, plans, programs and projects in disaster risk reduction.

Risk reduction is not a stand-alone sectoral theme but needs to be consciously integrated into our planning and implementation of development programmes and projects. It is becoming clear that the nature of vulnerability of poor is complex and varies. Hence there are no straightforward solutions for risk reduction for the poor. It will require multidimensional approaches and innovative institutional arrangements to achieve the goal of risk reduction for the poor. Community-based disaster risk management (CBDRM) is anchored in the disaster risk reduction framework. CBDRM covers a broad range of interventions, measures, activities, projects and programs to reduce disaster risks which are primarily designed by people living in at-risk localities and are based on their urgent needs and capacities.

Through CBDRM, vulnerable groups and communities can be transformed to become disaster resilient communities which can withstand and recover from stresses and shocks from the

natural/physical and socio-economic political or environment. Community-based disaster risk assessment provides the community and support agencies with disaster risk specific baseline data that can be integrated in a situational analysis for development planning purposes. Furthermore, it provides the community and support agencies with baseline data which is useful in doing the 'damage, needs, capacities assessment' of the community for emergency response purposes.

The Pressure and Release model (PAR model) is introduced in this research as a simple tool and part of the research project for showing how disasters occur when natural hazards affect vulnerable people. Their vulnerability is rooted in social processes and underlying causes which may ultimately be quite remote from the disaster event itself.

Because informal settlements in the City of Tshwane are diverse, risk reduction efforts will vary from one settlement to another or from one municipality to another, and almost always need to be tailored to local risk conditions and development capacities. Community-based disaster risk management (CBDRM) is an approach which aims to reduce local disaster risks through the application of participatory assessment and planning methods. It is a practical bridging strategy to integrate local development efforts on one hand with strategies that reduce the impact of priority disaster risks on the other. CBDRM aims to reduce vulnerabilities and strengthen people's capacities to manage specific disaster risks, though not possible to address all their day-to-day difficulties.

This chapter entails a background, theoretical framework on community based disaster risk management including the steps, benefits and characteristics of the community based disaster risk management. It further highlights the community based disaster risk assessment, its components and purpose. Furthermore this chapter also attempts to illustrate how the Pressure and Release (PAR) model will determine the "Progression of Vulnerability" as caused by the increased hazards and the vulnerability of community in Lusaka informal settlement. This chapter concludes by indicating policies and legislative requirements of community based disaster risk management as the theoretical background of the research and the community-based disaster risk assessment as the basis of the research.

Governments respond more to political pressure than to reasoned arguments to change their policies, and that pressure can best be exerted by those who suffer the effects of disaster,

namely people themselves and through their own autonomous organizations, which is known as community based organizations (CBO's) (Coburn *et al.* 1999). Through coordination CBO's are able to exercise control over large-scale mitigation measures, while retaining the essential match between local needs and actions (Maskrey, 1989). Applying such community-based policies depend on several factors namely the existence of active and concerned community groups (CBO's) and non-governmental organizations (NGO's) to provide technical assistance and support at an appropriate level are crucial to success (Coburn *et al*, 1991).

CHAPTER THREE:

RESEARCH METHODOLOGY AND DATA COLLECTION

3.1 INTRODUCTION

This chapter deals with discussions on research methodology, sampling techniques and data collection process. It also addresses the research investigation by highlighting the profile of the study area, discussion of semi-structured interviews, focus group discussions with the ward committee and ward councillor as well as additional meeting with the disaster management officials.

3.2 PROFILE OF THE STUDY AREA: LUSAKA INFORMAL SETTLEMENT

The township of Mamelodi (Lusaka) is 20km east of Tshwane (as indicated in figure 3) and was established in 1953 when black people were removed from other areas, according to the Group Areas Act (SA townships n.d.).

City of Tshwane (CoT) is divided into five regions (see a picture below) being the Northern, Southern, Eastern, North Western and the North Eastern regions. All these regions are at risk of possible disasters and needs disaster management activities and programs to be put in place. It is therefore in the interest of the municipality through the Disaster Management Centre to give guidance to the occupants on measures aimed at preventing and mitigating the unforeseen disastrous circumstances. As required by the Disaster Management Act 57 of 2002 the City of Tshwane is aiming to assess and prevent or reduce the risks of disasters, including ways and means of determining the level of risk and assessing the vulnerability of communities and households to disasters that may occur.

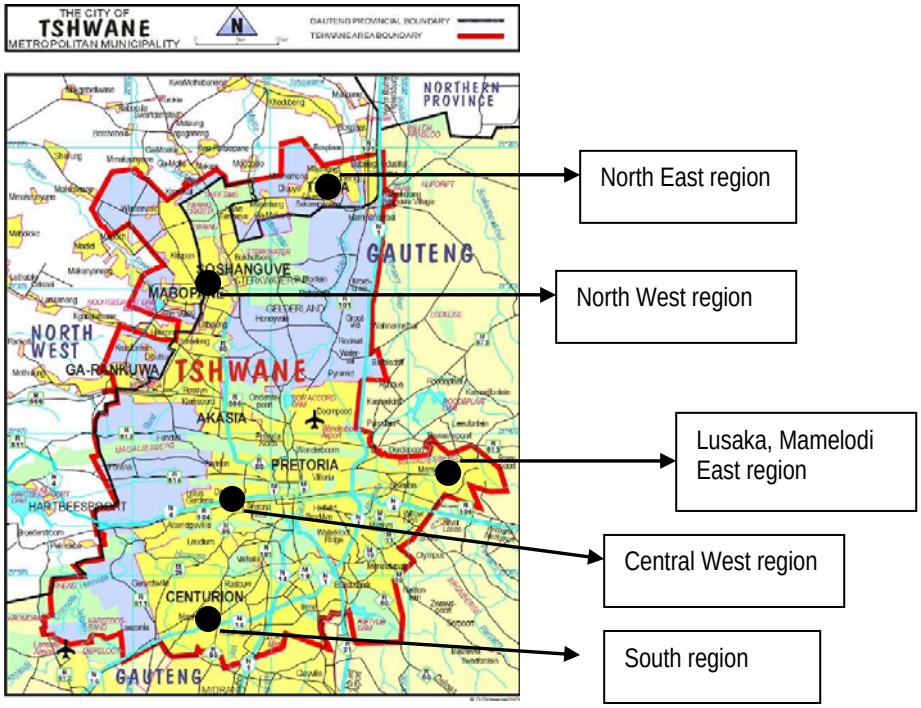


Figure 5: Map of CoT showing regions
Source: CoT Ward Atlas, 2007

Below is an aerial photo of Lusaka village.

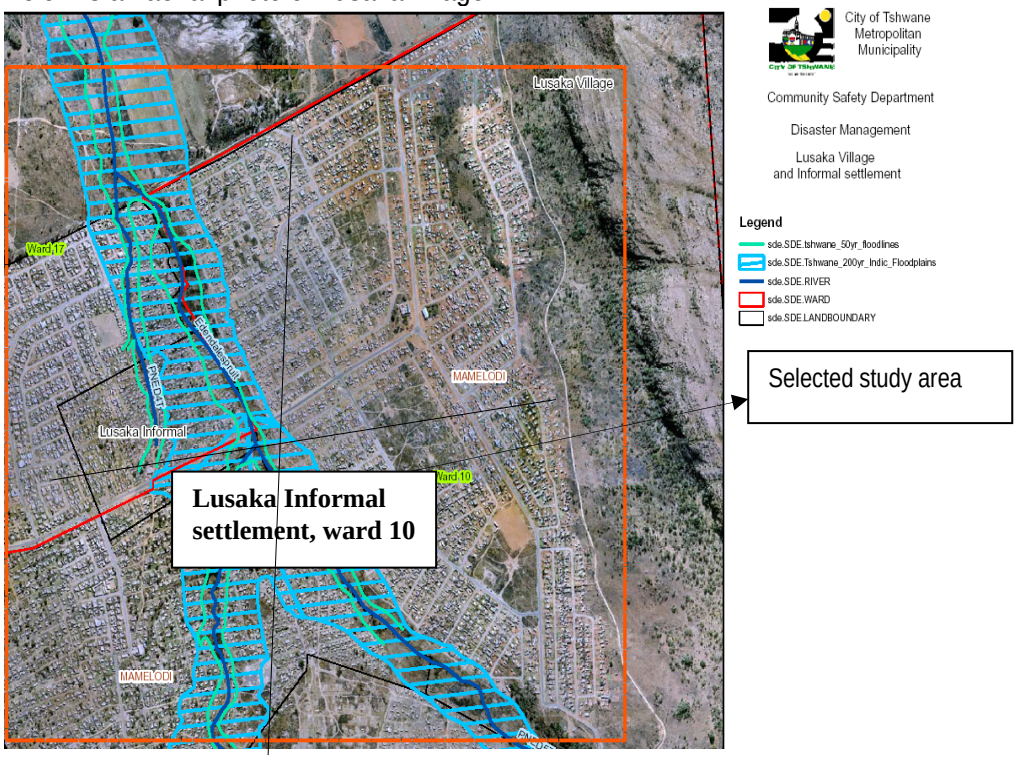


Figure 6*:* Aerial photo of Lusaka informal settlement

Source: CoT. 2007.

Figure 6 above shows the study area with the 200 year flood line and the river that runs across Lusaka (CoT, 2006). The purpose of this aerial photograph is to show hazard areas of Lusaka

informal settlement in ward 10. As the photo shows, there is one stream that crosscuts both ward 10 and ward 17. Two streams join into one. All the streams join the river alongside the village. Areas more at risk of inundation are those adjacent to the streams near Sizwe village in ward 10, more especially those that are at the streams confluence. Those vulnerable to flooding are subsequently left vulnerable to water-borne diseases. Because the half of ward 10 (Lusaka) is a low-lying wetland characterized area, it is vulnerable to runoff, which results from water rising above the earth surface due to soil saturation, leaving the area in swamps. Storms, though not very common, are likely to affect the whole area, most particularly infrastructure, with aggressive impacts on shacks and mud brick built structures.

3.2.1. General Description

Lusaka informal settlement (situated in ward 10) is situated in City of Tshwane Metropolitan Municipality near Mamelodi Extension 22 on the slopes of Magaliesberg Mountain range. From the fact that it is on the slopes of the mountain, it is evident that the northern (Mamelodi North) and far-eastern informal settlements (Lusaka, Mamelodi X 11 (section BB, BO, RR, Sizwe, Snake park and Mehlareng), 12, 18, 22 etc) already existed in 2000. According to a report from CoT (2005) the number of informal structures in Mamelodi increased from 16 449 units in 2001 to an estimated 24 561 units in 2005, and the current 28 282 units (CoT, 2006).

Mamelodi and Olievenhoutbosch are the only two areas to have recorded an increase in housing backlog between 2005 and 2007 (CoT, 2006). Moretele River forms a wetland on the eastern border of Mamelodi where the Lusaka informal settlement is situated. The Moretele River divides Mamelodi in eastern and western parts. The only vehicular access to Lusaka is through a low bridge with a single lane across the river. The Lusaka settlement is thus situated in a wetland area within the 200 year flood line with lack of access (and therefore escape) roads. This area is situated far (50km) from resources and economic activities. The entire population of Ward 10 is racially identified as black (African). Sepedi is the largest home language in Ward 10 (48.0%), followed by Xitsonga (15.0%), IsiZulu (11.0%) and IsiNdebele (8.8%) (CoT, 2007).

The ward is densely populated and is characterized by the presence of informal residential units typically constructed of inferior (often flammable) materials which are also not resistant to extreme weather events (e.g. storm), floods and fires (CoT, 2007). Only 13.0% of households have access to electricity and 14.0% have sewer toilets. This leaves people vulnerable to fire

(from alternative lighting/heating sources) as well as to diseases from lack of basic sanitation (CoT, 2007).

Poor people often put themselves at risk when they occupy areas of land that are considered hazardous, because of a lack of suitable land to live on close to urban areas. There is thus not only a need for suitable land, but also for non-hazardous land (CoT, 2005). It is therefore a need to place disaster management activities in the area to ensure community awareness, involvement and participation in proactive disaster management.

3.3. RESEARCH METHODOLOGY AND DATA COLLECTION

3.3.1. Research methods

This section explains the ways in which the research was conducted. It discusses the research methods, methods of data collection and the semi-structured interviews, and time schedule of data collection. A sample of residents was selected randomly to include different areas (community) in the study area to conduct interviews with. The total sample size was 80 residents (but only 77 respondents completed the questionnaires); with a mean of 20 people per each selected area.

3.3.2. Research Design

A research design guides the researcher in planning and implementing the study in a way that is most likely to achieve the intended goal (Scrimshaw, 1990; Zhang, 2001).The research design was descriptive and explorative. A combination of quantitative and qualitative research methods were used because they compliment each other (Scrimshaw, 1990; Zhang, 2001). A qualitative research is directed towards discovering new insights, meanings and understandings. It is an in-depth analysis of the problem in order to understand the 'what' and 'why' of human behaviour (Scrimshaw, 1990; Zhang, 2001). According to Scrimshaw (1990) and Zhang (2001), exploratory research is the exploration of unknown research area in order to gain new insight into the phenomenon being studied. It therefore adopted an exploratory approach through employing in-depth semi-structured individual interviews to explore the development of Community-based Hazards and Vulnerability Assessment. Philosophical foundations, characteristics and techniques can be found in both quantitative and qualitative research, each with its own strengths and weaknesses (Wittenberg and Sterman, 1996). According to Wittenberg and Sterman (1996), descriptive exploration describes what the fieldworkers observed during the fieldwork. Past research has tended to focus exclusively on

knowledge production from an analytical-empirical perspective, using traditional quantitative methods associated with the dominant scientific paradigm (Bolin, 2003). However, a possible integration of research methods, based on either simultaneous or sequential mixing of quantitative and qualitative values and techniques, is perhaps the best avenue to find the answers to questions posed, and being influenced by the community based approach (Wisner, 2004).

Quantitative methods were also incorporated into the study. According to Scrimshaw (1990) and Zhang (2001), a research method that relies less on interviews, observations, small numbers of questionnaires, focus groups, subjective reports and case studies but is much more focused on the collection and analysis of numerical data and statistics. Quantitative research was used to address questions that were predominantly based on the objectives of the study. Examples include aspects surrounding disaster risk management, risk assessment and response and recovery as well as community participation and involvement within Lusaka. In contrast, a more qualitative theoretical framework, such as the policy of disaster management and the CoT disaster management plan and framework and other related books from the subject, were used to address issues from the objectives. In addition, this approach was used to collect sensitive data, such as gender roles, income and assets (i.e. livelihoods).

Focus group discussions and key informant interviews were used to collect qualitative and quantitative information. In general, research was conducted in three stages: orientation and exploration, confirmation and refinement. Using mixed-method research enabled the triangulation of data and increased analytical power, as each data source assisted in the interpretation of the other (Meinzen-Dick *et al*., 2003).

3.3.3. Methods of data Collection and time lines

The samples of people were chosen with the use of the non-probability sampling method called: reliance on available subjects. The method guarantees that different demographics of people are interviewed. The survey was careful to ensure that the people who participated volunteered and were not forced to be interviewed. To ensure anonymity, participants were not required to provide their personal information such as their names, residential addresses or contact details. The methods of data collection included completion of the semi-structured questionnaire and interviews, and field observation. Field notes were compiled and analysed. The following section examines two methods of data collection that were undertaken: semi-

structured questionnaire and key informant interviews with the community members focus group discussions, with the ward councillor and the ward committee members and the City of Tshwane disaster management officials respectively. Data collection during the project mainly focused on the following aspects:

- A formal review of literature pertaining to all the applicable documented data included in scientific reports or publications, policy documentation and legislation.
- Statistical data collection and review regarding population demographics, which could confirm the hazards and vulnerabilities in the study;
- Data on hazards and vulnerabilities that are applicable to the disaster risks in the study area and areas with similar characteristics; and
- Semi-structured interviews were held with a representative sample of community and also disaster management practitioners interviewed; and
- Key informant and focus group discussion with the disaster management officials and the ward councilor.

Additional information pertaining to the study was attained by accessing the relevant information from media such as journal articles, books, other research thesis and the use of recorded data. As noted in chapter one on conducting fieldwork, the settlement was divided into four (4) blocks for conducting fieldwork and each block was allocated three fieldworkers. The field workers were trained in terms of administering the questionnaires and also how to communicate or ask the participants questions. Participants in this study were selected on the basis of their acknowledged residence status in Lusaka informal settlement, upon consultation with the local leadership structure (ward councillors, ward committees, NGO's and community members).

The main method applied in this study was thus to utilize volunteers from NGO's and the ward committee members residing in Lusaka settlement. They were employed and trained to administer the questionnaires. These were distributed to a randomly selected population in the study area by trained fieldworkers. The questionnaires were composed of a number of questions that were drawn from the review of selected literature and research findings on the community based disaster risk management, environmental and living conditions in Lusaka informal settlement and other informal settlements within the City of Tshwane (Questionnaire attached in Annexure A).

For purposes of providing data for the study, preference was given to participants who had resided in the area for a period of five (5) years or longer. Age eligibility for participation in the study was early adulthood (twenty-five to forty years of age) and middle age (those aged between forty to sixty years), irrespective of gender.

Owing to the size of the settlement and time limitations for the study, the fieldworkers were trained in the content of disaster management and the research questionnaires and its administration, and worked in accordance within the three-week schedule as depicted in Table 1:

Table 3: Time schedule for data collection

Day 1	Day 2	Day 3
Three-hour A meeting with volunteers/fieldworkers and NGO's was held to discuss the purpose of the research and the training of volunteers who are going to pilot the questionnaires. Two-hour Another meeting with Ward Councillor Mogaladi and the ward committee members was to inform and also invite the Clr. To participate and also inputs on the study of community-based Hazard and Vulnerability Risk Assessment approach.	Six-hours During these hours, a house-to-house interview for the completion of questionnaires was conducted. Two hour After the randomly selected interviews, there was a debriefing with the volunteers from the community in different sections, and members of ward committee.	Two-hour Discussion of the completed questionnaires. Two-hour Meeting with officials working for the CoT Disaster Management Centre as well as the Ward clr. and DM committee to discuss possible risk reduction measures regarding the outcome of the research and projects implemented in the study area and also a follow-up for the open ended questions. One –hour Another follow-up meeting was conducted to finalise with the ward clr. The interviews.

3.3.4. Semi-structured interviews

The semi-structured interview was a method utilised in order to explore, define and obtain additional data that would be beneficial to this research. The semi-structured interviews with the ward councillor ward and disaster management ward committee members and community members who have more than three years experience in the area of study. Two disaster management practitioners (officials of the City of Tshwane) were requested to partake in the semi-structured interviews.

The semi-structured interviews were preceded with a questionnaire, which contained five open-ended questions. These questionnaires were handed to each of the participants before the actual interviews took place in order for them to be well-prepared and obtain additional information that they may not have off-hand. It also provided the participants with guidelines to what the topic of discussion is all about.

3.3.5. Focus group interview

There was a discussion with the CoT Disaster Management officials regarding the risk reduction strategies and if there are any community approaches the City of Tshwane is adopting.

Through key informant interviews, underlying nuances and confidential information often were revealed that does not occur when other research methods are used. Members interviewed spoke freely of local incidents, conditions and underlying constraints in the community. In addition, the interview was set to allow flexibility and to explore new and unanticipated issues which were relevant to the study. The disadvantage of this method is its difficulty to determine whether the respondents are knowledgeable, adequately informed or accurately reflect the opinions of the group(s) they are representing.

Furthermore, a meeting was held between the researcher, Non-Governmental Organisation (NGO) leader (Mr. Jacob Khangele), the Ward Councillor (Clr. Mogaladi), ward committee members and the volunteers from the Lusaka community.

The focus group discussions took place at the homesteads of the community ward councillor. The participants were informed of what was required both in terms of content and process, and the amount of time needed. Detailed notes were made by the facilitators and the researcher.

These were later compared and discussed to ensure that all issues raised had been recorded. The issues for discussion were introduced and participation by all was encouraged. On average, the focus group discussions lasted two to three hours each.

3.3.6. Data analysis

Data from the completed questionnaires were captured and analysed from the University of Pretoria department of Statistics. The data analysis in chapter four was performed using Statistical Predictive Performance Systems (SPPS) and direct calculations. Analyses of data included hazard and vulnerability assessment and knowledge of disaster, hazard and vulnerability, gender, level of education, length of stay and risk reduction strategies implemented in the community of Lusaka.

3.4. SUMMARY

This chapter highlights hazard identification and vulnerability assessment in the Lusaka informal settlement. The community is assessed for vulnerability to various hazards and the following section will provide solutions to address the identified hazards. The profile of the study area was also discussed. The chosen methods of attaining the data required made it simpler to acquire the necessary information for the study in an organized manner, making the process of doing the field work less costly and not time consuming.

The data attained from the community of Lusaka helped with accomplishing the objective of developing the hazard and vulnerability assessment framework.

CHAPTER FOUR:

DATA ANALYSIS

4.1. INTRODUCTION

This chapter focus on data analysis. It also aimed at identifying and/or analysing the vulnerability factors and hazards regarding Lusaka informal settlement, and will also help in developing risk reduction measures for the community of Lusaka as part of the discussion for the next chapter. The graphs and discussions presented below were derived from the Questionnaire and interviews.

4.2. PERSONAL PROFILES

Question 1

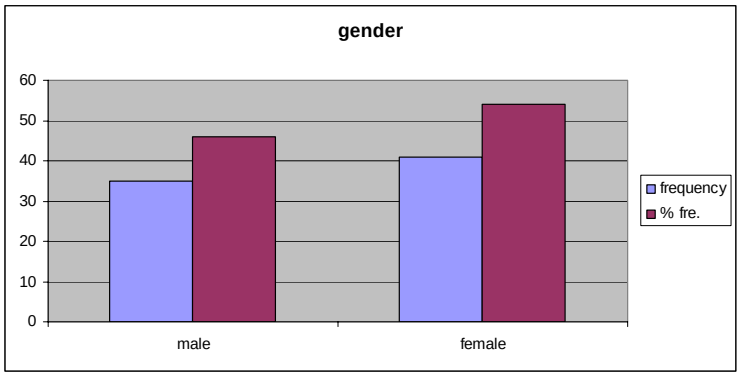


Figure 7: Personal profile of Lusaka community, ward 10.

According to the research analysis, of the 76 respondents from the residents of the study area, 54% were female and 46% were male. This shows that there are more women residing in Lusaka and in terms of disasters they would suffer more due to employment and poverty.

Question 2

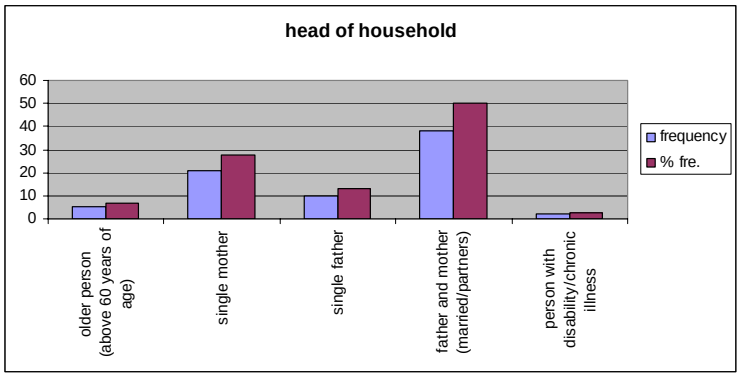


Figure 8: Number of head of household for Lusaka

50% of the families in Lusaka had a father and mother as head of the household, followed by single mothers amounting to 28%. Single fathers amounted to 13% of the respondents interviewed. Seven percent of the respondents were headed by an older person above the age of sixty while three percent of the household was headed by persons with disabilities. Having an average families residing in Lusaka shows that the area is growing and that more disaster management activities should be introduced since a number of children will increase.

Question 3

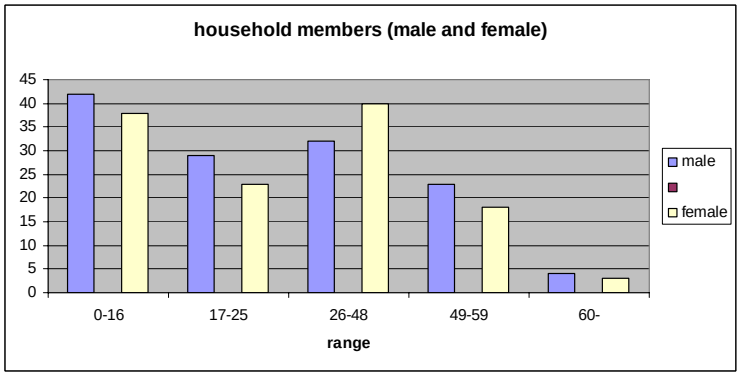


Figure 9: Household members.

From the age group 0-16 years, 32% were male and 31% were female. From the age group 17-25 years, 22% were male and 19% were female. From the age group 26-48 years, 25% were male and 33% were female. From the age group 49-59 years, 18% were and 15% were female. From the age group 60 and above years, 3% were male and 2% were female. In addition to that, it is also clear that the average age of 35 can be able to deal with the disaster situation since there are less elders and disabled people.

Question 4

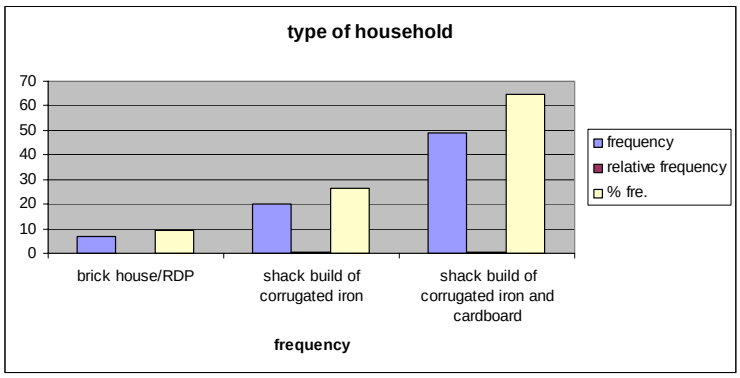


Figure 10: Type of household

Nine percent of the respondents in Lusaka live in brick houses/RDP houses while 26% of the respondents live in shacks build of corrugated iron. From the data analysis, it is clear that 64% of the respondents live in shacks build of corrugated iron and cardboard. According to the analysis, most people living in Lusaka are venerable to floods and shack fires. This means that CoT has to conduct awareness campaigns to the community of Lusaka to reduce the impact of disasters. This is also one of the reason there is an increase number of incidents during winter and rainy season.

Question 5

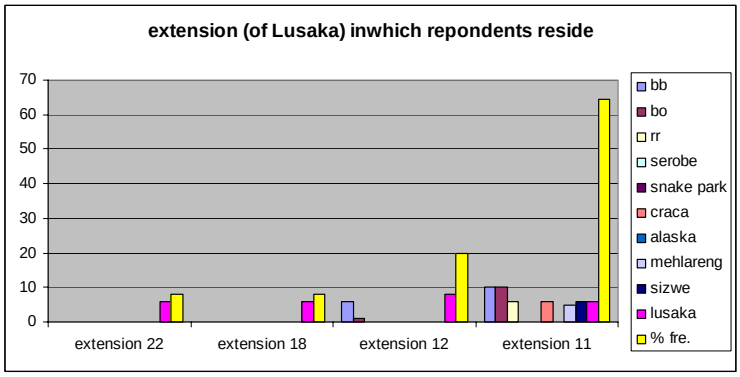


Figure 11*:* Extension and sections of Lusaka settlement ward 10

According to the CoT report (2008) and the data analysis report, of the 76 respondents residing in Lusaka informal settlement in ward 10, 8% live in extension 22 and extension 18, 20% live in extension 12 and the rest of the respondent reside in extension 11 with an average of 64%. According to the CoT report (2008), within extension 11, it is where the problems of floods and shack fires are mostly reported.

Question 6

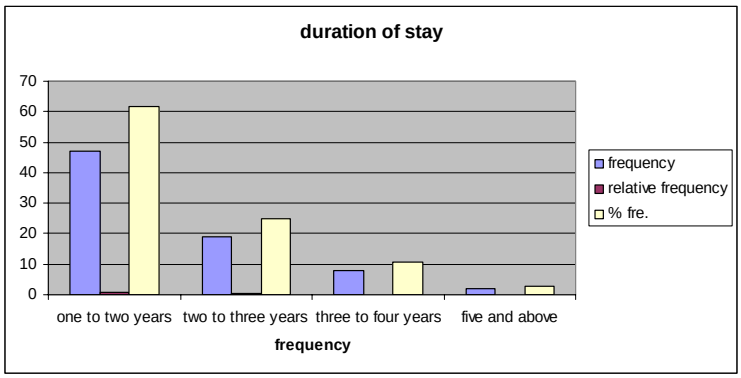


Figure 12*:* Duration of household stay in Lusaka settlement.

62% of the respondents have stayed in Lusaka for one to two years. 25% of the population have stayed in the township for two to three years while a 14% of the respondents have been residing in the area for more than 3 years. It is clear that most of the community knows the area very little since majority of the community only lived in Lusaka for at least 2 years. These bring back to the number of people residing in Lusaka and thus cause a problem in terms of shortage of human settlement (CoT, 2008). According to CoT report (2008), people reside anywhere just to be close to the work environment or job opportunities. The development of the Community-based Hazards and Vulnerability Assessment will lead to development of Lusaka risk profile for CoT the Disaster Management Centre to be able to develop and implement projects and programmes for the community of Lusaka.

4.2. EDUCATIONAL BACKGROUND

Question 7

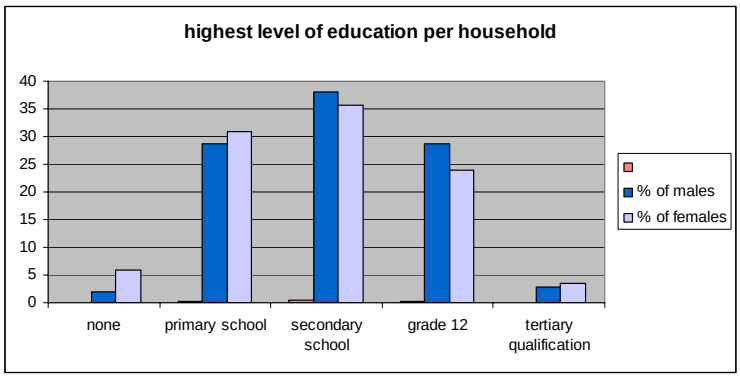


Figure 13: Highest level of education per household

Of the 76 respondents, two percent of males and six percent of females have no education background. 29% of males and 31% of females have primary education. 38% of males and 36% of females have secondary education. 29% and 24% of females have grade 12 qualifications. Three percent of males and four percent of females have tertiary qualifications. In this case, young people will be encouraged to go to school and through the intervention and coordination of CoT Disaster Management Centre, department of Education can intervene by increasing access to free education.

Question 8

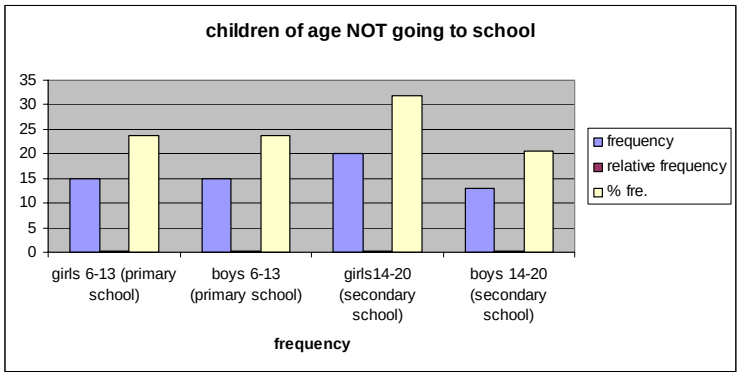


Figure 14: Age of children not going to school.

For the question: how many children of school going age do not go to the school, 24% of girls and boys between the age of 6-13 do not go to school while children 32% of girls between the age 14-20 do not go to school. 20% of boys from the age group 14-20 do not go to school. This shows clearly that parents do not encourage kids to go to school, therefore; the study will also advise the CoT departments to bring community programmes within Lusaka settlement. Through the establishment of community structures such as disaster management ward committees, community policing forums, Youth social development forums, and etc. will assist in building the community of Lusaka.

4.3. CAPACITY ASSESSMENT

Question 9

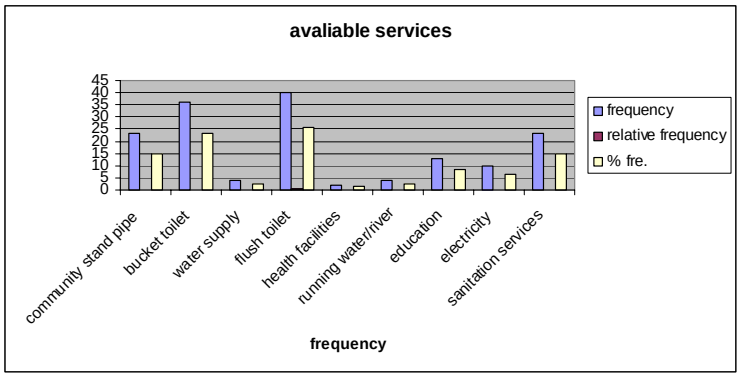


Figure 15*:* Available services.

Flush toilets and bucket toilets were shown to be the most available services in Lusaka amounting to 26% and 23% for the latter. Community stand pipes and sanitation services both amounted to 15%, followed by education at eight percent and electricity at six percent. The least said available services were water supply and running water both at three percent. One percent of the respondents said that they have health facilities available to them.

Question 10

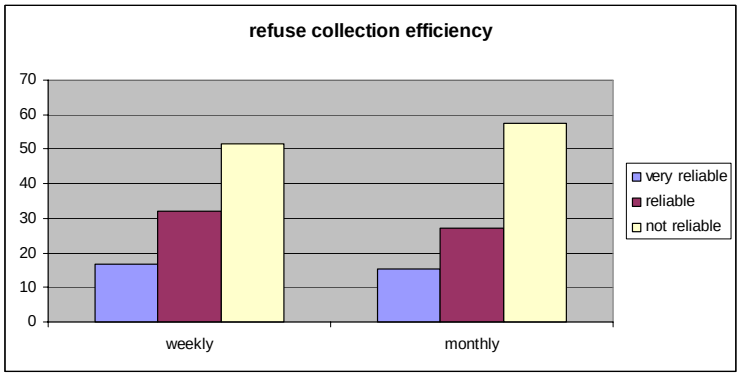


Figure 16: Refuse collection efficiency.

51% of the respondents said that they did not find the weekly refuse collection efficient in their community while 17% of the respondents found it to be very reliable. The rest said that it was reliable. 58% of the respondent said that they did not find the monthly refuse collection efficient in their community while 15% of the respondents found it to be very reliable. 27% of the respondent said that the monthly refuse collection was reliable. Refuse collection is part of reducing health problems during floods, and it is also one of the causes of drainage blockage

and even furrows running between the settlement. Therefore, if refuse can be collected reliably, this could reduce the floods incidents.

Question 11

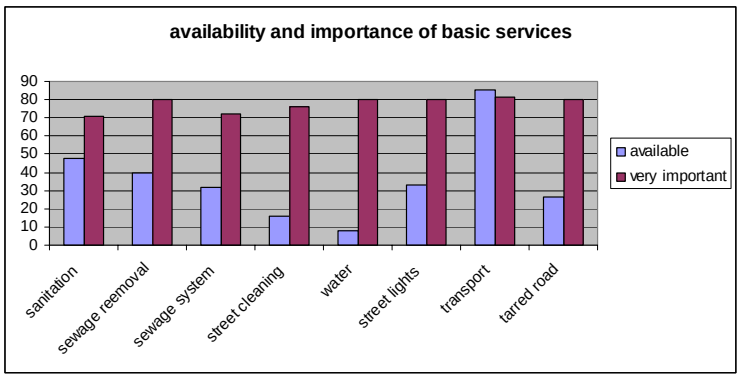


Figure 17: Availability and importance of basic services.

47% of the respondent said that sanitation was available in their community and 71% said that it was very important. Thirty nine percent of the respondent said that sewage removal was available and 80% said that it was very important. Thirty two percent of the respondents said that sewage systems were available in the community and 72% said that it was very important. Sixteen percent of the respondents said street cleaning was available and 76% said that it was important. Eight percent said that water was available and 80% said that it was very important. Thirty three percent of the respondents said that street lights were available in the community and 80% said that it was very important. 86% of the respondents said transport was available and 82% said that it was important. 26% said that tarred road was available and 80% said that it was very important.

4.4. COMMUNITY BASED DISASTER RISK MANAGEMENT

Question 12

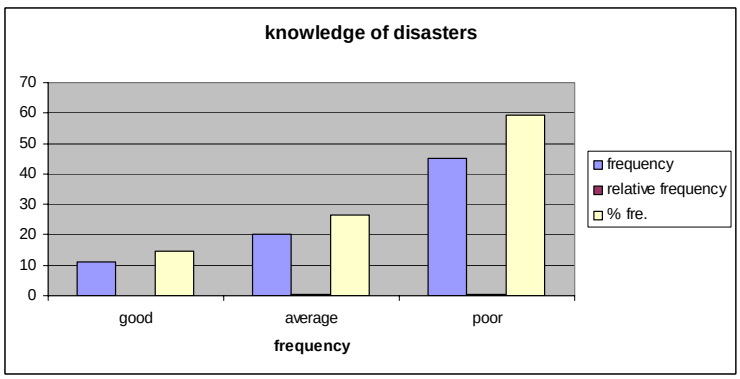


Figure 19: Knowledge of disaster.

Most of the respondent said that their knowledge of disasters is poor, at 59% while 26% said that their knowledge is average. From the 76 respondents; 14% said their knowledge of disasters is good. The research will recommend suggestion for disaster management programmes to be implemented to this community. Indications from the analysis shows that people are not aware of the dangerous situation they are settling during disasters. The community of Lusaka can be educated about their dangers through recommendations made out of this research.

Question 13

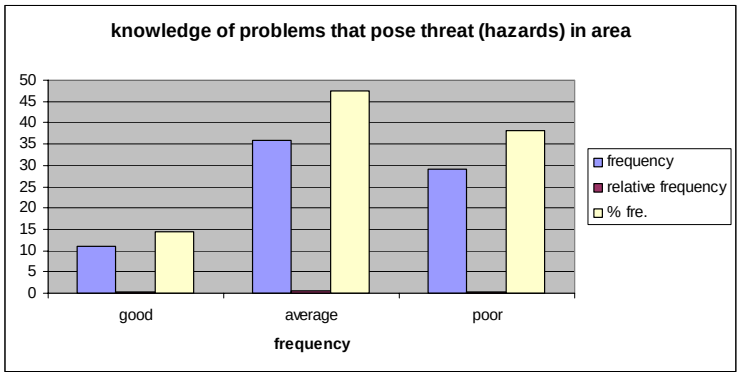
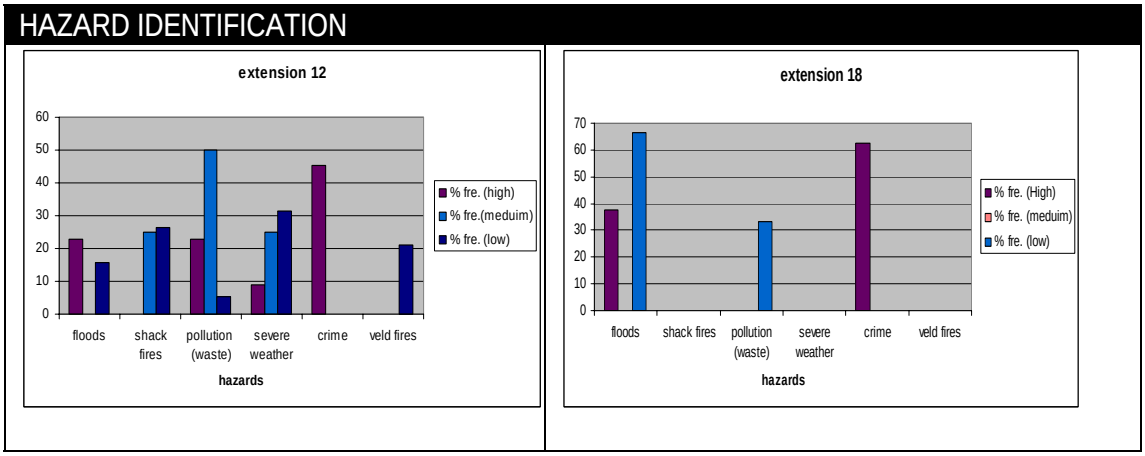


Figure 19*:* Knowledge of problems that pose threat in Lusaka.

47% of the respondents stated that their knowledge of any problems that pose threats in the community is average. 38% stated that their knowledge of threats in the community is poor and only 14% of the respondents had knowledge concerning problems that poses threats in the community. It is again clear that disaster management centre need to intervene as soon as possible.

Question 14



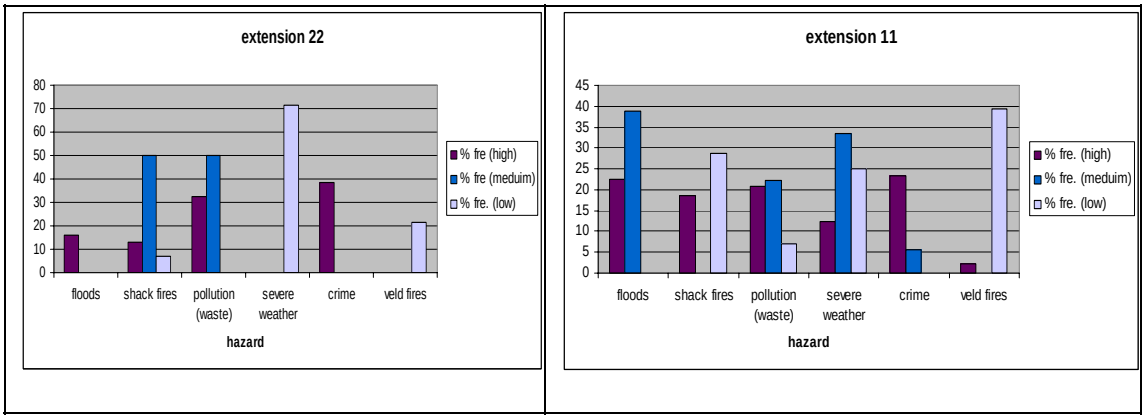


Figure 20*:* Hazard identification.

According to the respondents, in extension 12, floods and crime have a higher probability of occurring, while shack fires, severe weather and veld fires have a lower probability of occurring. Waste pollution has a medium probability of occurring in the area.

The respondents from extension18 stated that floods and waste pollution have a medium probability of occurring while crime was said to have a high probability of occurring.

In extension 22, shack fires and waste pollution were said to have a medium probability, as compared to severe weather and veld fires, which were said to have a low probability of occurring. Floods and crime were said to have a high probability.

In extension 11, crime was the only hazard that was reported to have a high probability, whereas floods, severe weather and waste pollution have a medium probability of occurring. The two hazards that were reported to have low probabilities of occurring were shack fires and veld fires.

Question 15

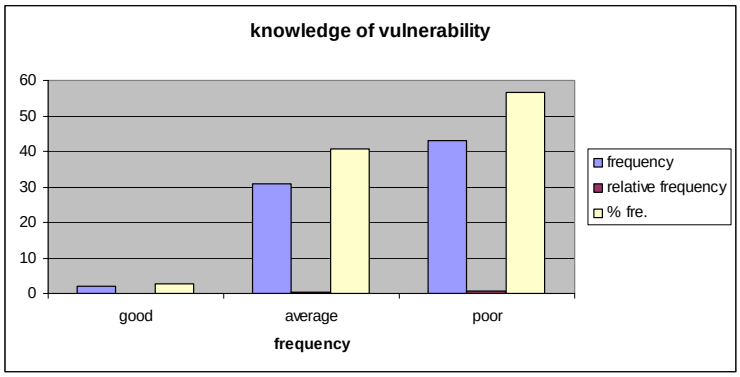
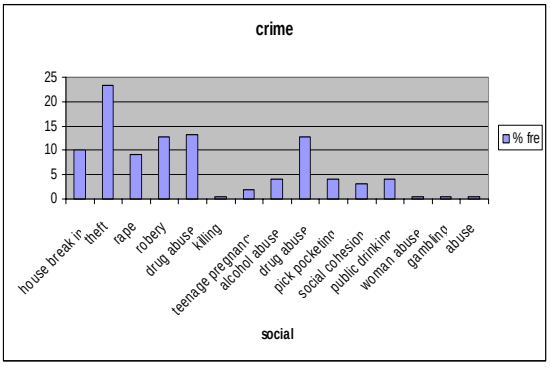
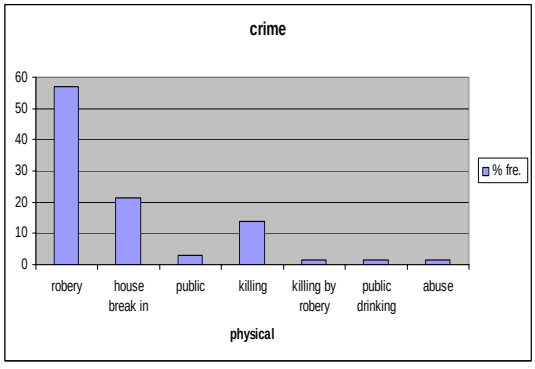


Figure 21: Knowledge of vulnerability.

57 of the respondents said that their knowledge of vulnerability was poor, 41% said it was average and three percent said it was good. The research will recommend suggestion for disaster management programmes and projects to be implemented to this community. Indications from the analysis shows that people are not aware of the dangerous situation they are settling during disasters. The community of Lusaka can be educated about their dangers and vulnerabilities through recommendations made out of this research. If the CoT DMC can implement this research recommendation properly, they could have a resilient and sustainable community. Through the development and approval of the suggested recommendations, CoT can at the same time reduce the complaints regarding service delivery issues.

Question 16

CRIME	
	

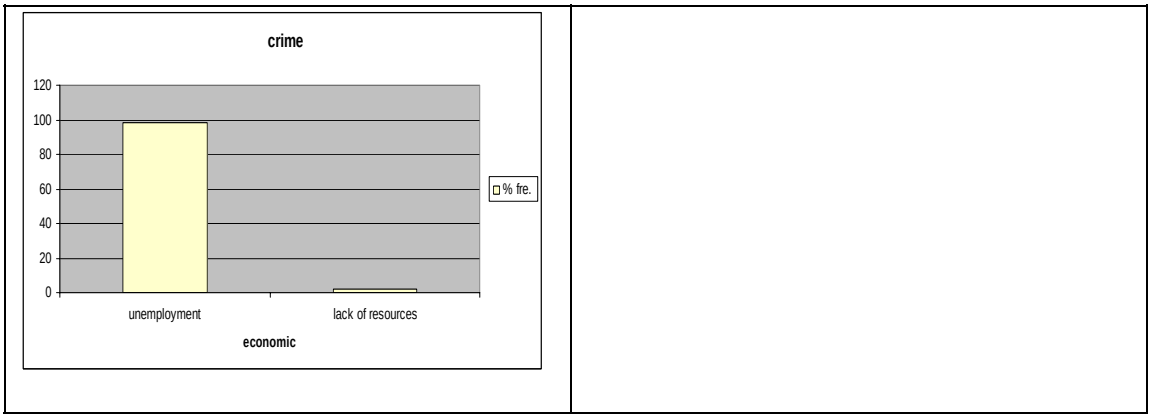


Figure 22: Crime

From the crime analysis data; theft crime, robbery and drug abuse were reported to be the highest social hazards. Physical hazards of high potential included: robbery, house burglaries and killings. Unemployment was reported to be the biggest contributor to the economic constraint in the area.

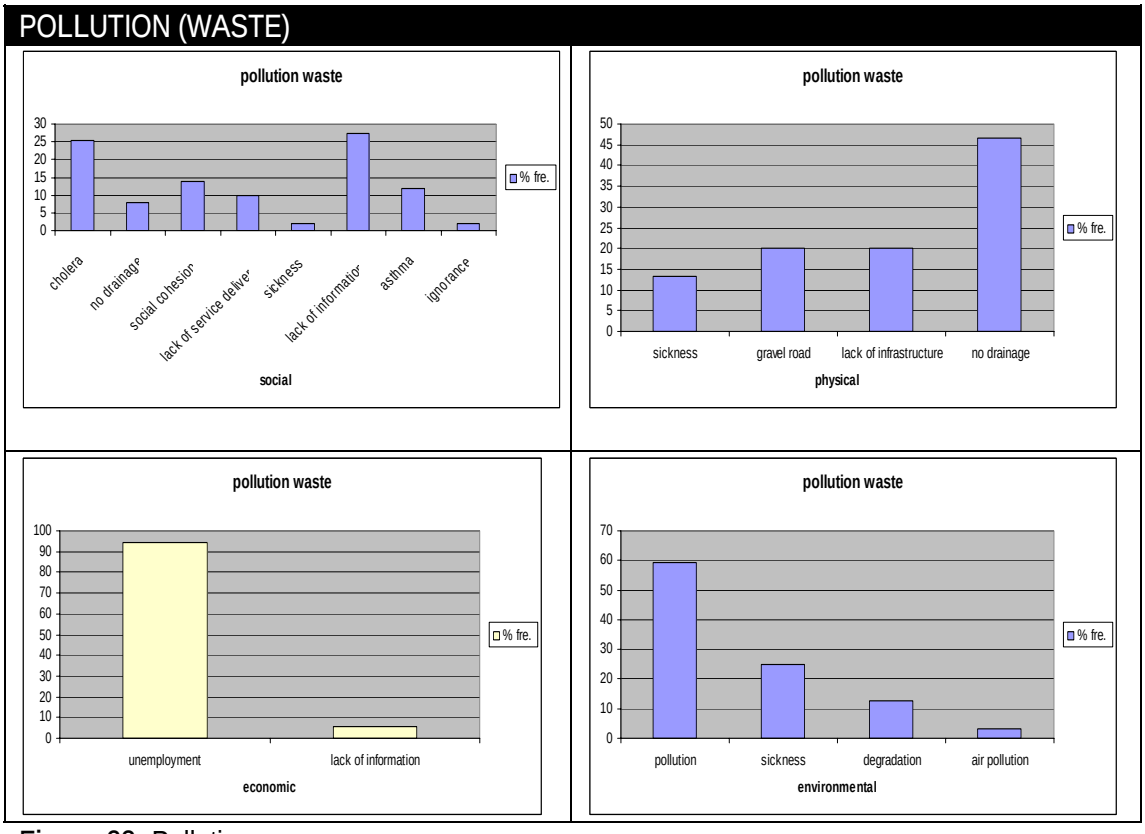


Figure 23: Pollution

Shortage of information and services regarding pollution was reported to have a higher contribution in the community's social vulnerability analysis. On the physical aspect, the pollution hazard was reported to be a result of the unavailable drainage system, lack of infrastructure in terms of formal houses and tarred road. Unemployment was reported to be the

biggest contributor to the economic constraint in the area while pollution was reported to be the biggest contributor to the waste pollution crisis to the community of Lusaka since there is shortage/and no access to electricity.

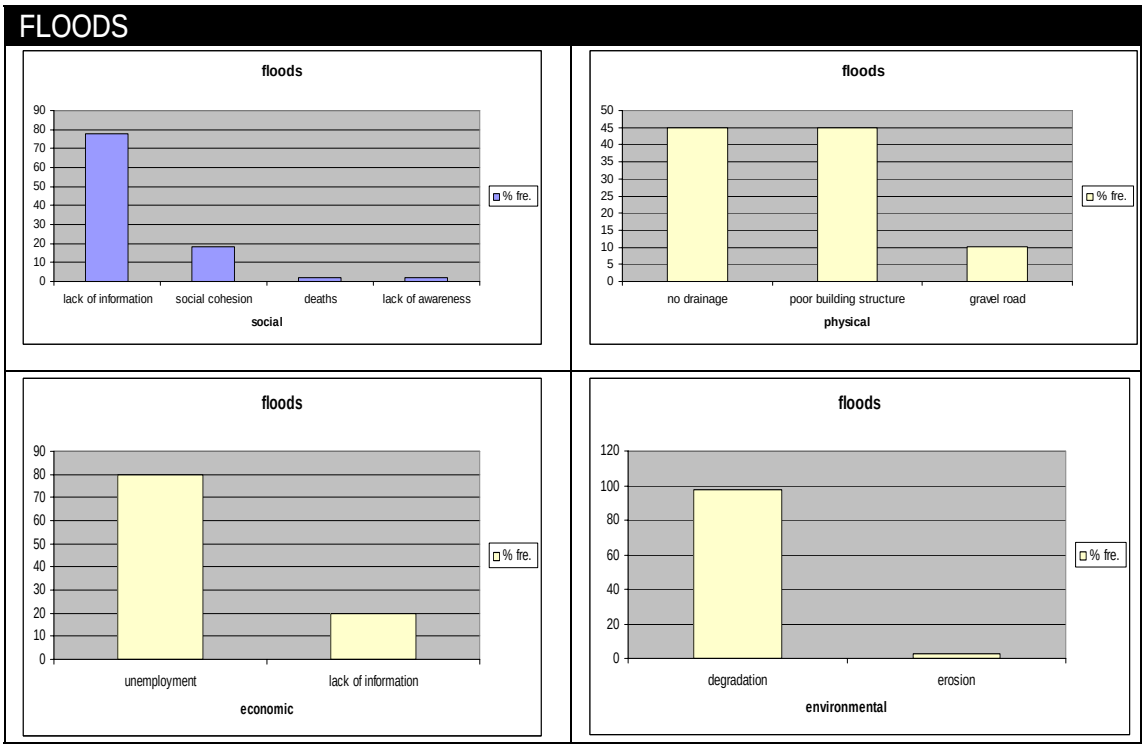


Figure 24*:* Floods.

From the social aspects of floods in the vulnerability assessment, lack of information was reported to be the largest problem. From the physical vulnerability assessment, no drainage and poor building structure were shown to be the largest predicament. With regards to the economy unemployment bore the largest constraint. Degradation was reported to be the largest result from the environmental vulnerability assessment. Once the CoT DMC has established disaster management committees within the community of Lusaka, they can be trained so that those committees can further educate their own people about their surrounding hazards and vulnerabilities. This can be done continually in conjunction with the DoT DMC officials.

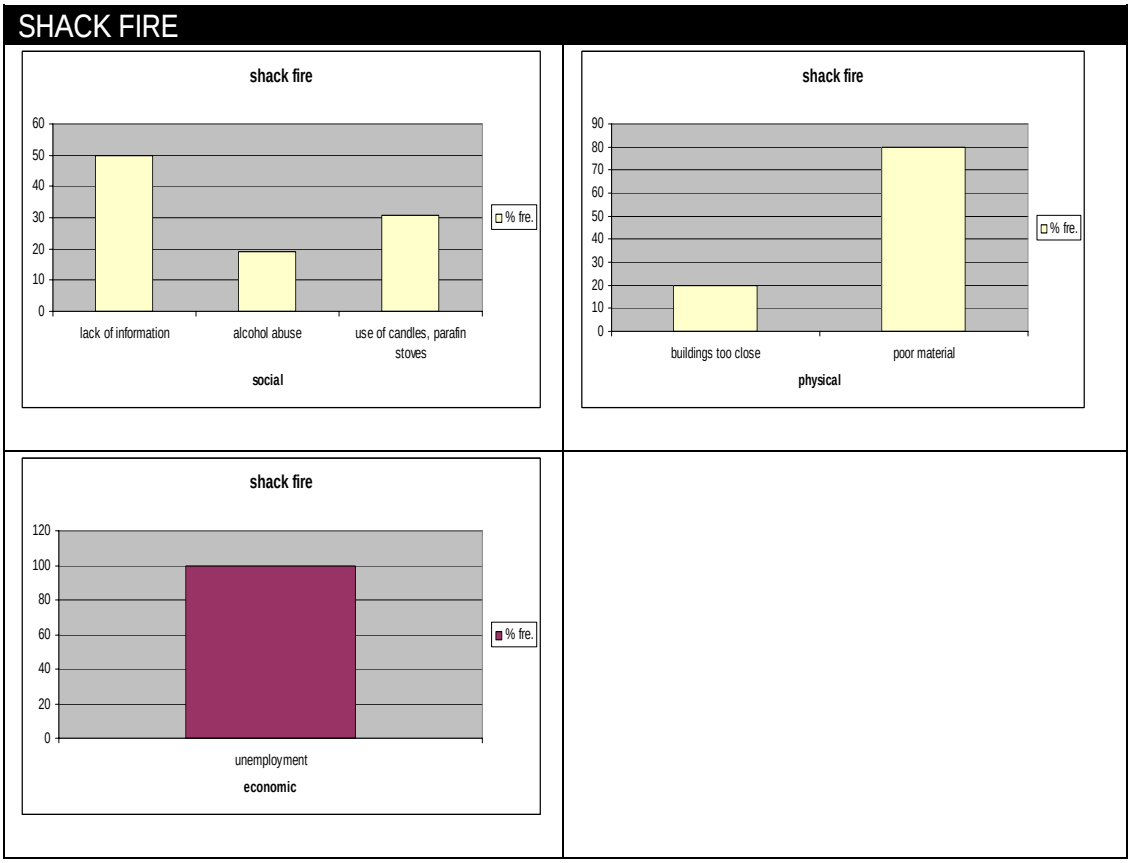


Figure 25*:* Shack fires.

Shack fires were another element reported on in the vulnerability assessment. With regards to the social aspect of the assessment, lack of information and the use of candles as well as paraffin stoves were the highest contributors to shack fires. Poor materials were reported to be the larger contributor to shack fires on the physical side of the assessment. Unemployment was the largest economic constraint reported in the assessment. People should be encouraged to take responsibility for their social behaviour, since this is one of the causes for fire incidents due to alcohol abuse (TIEP, 2008).

Question 17

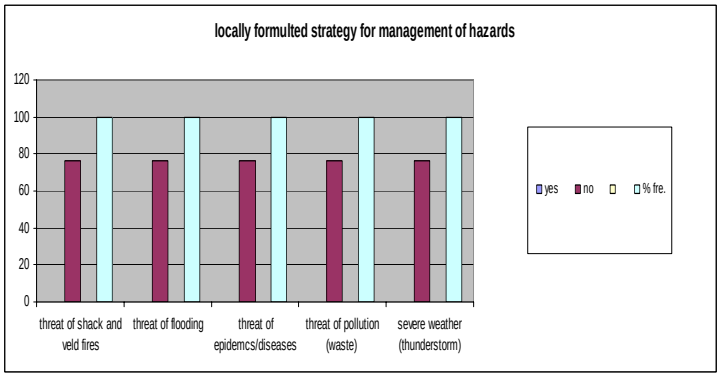


Figure 28*:* Formulated strategy for fire and floods.

All the respondents interviewed said that there were no locally formulated strategies for the management of the above stated hazards (threat of shack and veld fires, threat of flooding, treat of epidemics/diseases, threat of pollution and severe weather) in the area.

Question 18

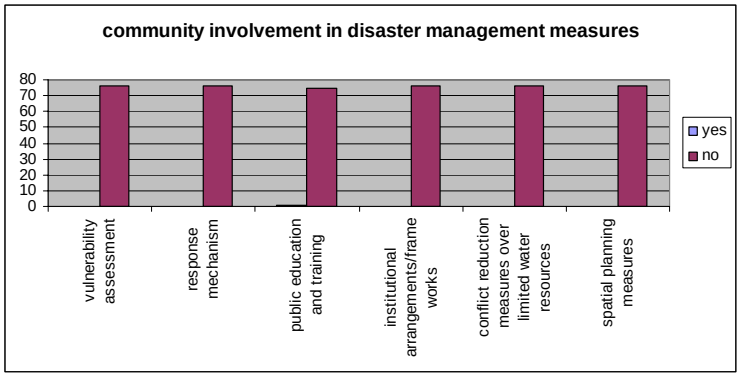


Figure 27: Community involvement in disaster management measures.

A hundred percent of the respondent said that they have not been involved in the planning of the following disaster management measures: vulnerability assessment, response mechanism, institutional arrangements/frameworks, spatial planning measures and conflict reduction measures over limited water resources. Ninety nine percent of the respondent said that they have not been involved in the planning of public education and training disaster risk management measures. Although 1% of the respondents that said that they have been involved in the planning of public education (awareness campaigns) and training disaster risk management measures, they found the strategy to be non effective due to the fact that there is no sustainability of the disaster risk management programs within the community of Lusaka.

Question 19

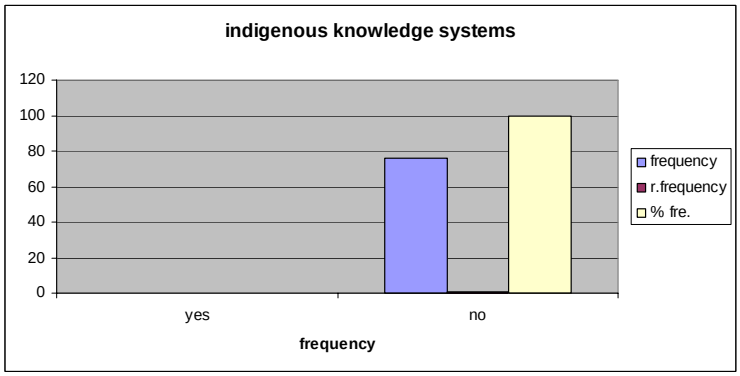


Figure 28*:* Indigenous knowledge.

All of the respondents interviewed said that indigenous knowledge systems were not incorporated sufficiently in the management of the following hazards: threat of shack and veld fires, threat of flooding, treat of epidemics/diseases, and threat of pollution. It is important for CoT DMC to respect local knowledge and also incorporate that knowledge into their policies.

4.5. SUMMARY

This chapter entails analysis of data collected from the study area (Lusaka informal settlement, ward10). The chosen methods of analysing data required made it simpler to capture and discuss the necessary information for the study in an organized manner, making the process of doing the analysis work easier for the researcher to interpret.

Analyses of data included hazard and vulnerability assessment and knowledge of disaster, hazard and vulnerability, demographic profile, gender, level of education, length of stay and risk reduction strategies implemented in the community of Lusaka. From this pint of discussions, it is clear that the participatory approach is necessary for the implementation of disaster risk management to the community of Lusaka.

CHAPTER FIVE:

INTERPRETATION AND DISCUSSION OF RESULTS

5.1. INTRODUCTION

The preceding chapter is based on the analysis of the data from the community survey and the data from the CoT disaster management centre that could help inform planners and decision makers of methods that will help minimize the impacts of disasters in communities of Tshwane.

This chapter introduces a simple model of the way in which 'underlying factors' and root causes embedded in everyday life give rise to 'dynamic pressures' affecting particular groups of community, leading to specifically 'unsafe conditions' (Wisner *et al*, 2004).

When these underlying factors and root causes coincide in space and time with a hazardous natural event or process, people think of the community whose characteristics have been shaped by such underlying factors and root causes as 'vulnerable' to the hazard and 'at risk to disaster'. This will be referred to as the 'Pressure and Release' (PAR) model, since it is first used to show the pressure from both hazard and unsafe conditions that leads to disaster, and then how changes in vulnerability can release people from being at risk (Wisner *et al,* 2004).

5.2. DISCUSSION OF THE RESULTS: PROGRESSION OF VULNERABILITY APPLICATION

It is clear from the interviews that the application of progression of vulnerability was used as part of the community based hazard and vulnerability assessment. This PAR model is divided into three phases, namely; the root causes, dynamic pressures and the unsafe conditions. Hazards have always been part and parcel of world's reality, and populations inhabiting hazard-prone areas adapted strategies to deal with extreme events using their own capabilities, knowledge, skills, talents and technologies (Heijmans, 2001).

Hazards are having an increasing impact on society as a result of rising levels of human vulnerability. In this respect disasters are not isolated events, but a manifestation of the development (La Trobe, 2005). There is, therefore, much that people don't yet know about potential extreme events. More critically still, however, are those threats that hazard and risk

scientists are aware of, but which the governments of endangered countries ignore (Guardian, 2005). Twigg (2001) pointed out that two important conceptual models were developed to give disaster managers a framework for understanding vulnerability to disasters and for reducing it:

- Capacities and vulnerabilities analysis (Anderson & Woodrow;1989/1998)
- Pressure & release /access models (Blaikie *et al* .1994).

The pressure model can be applied in the practical assessment of vulnerability and the crunch model depicts that the progression of vulnerability plays an integral part in understanding the impact of the disaster on a community (Van Niekerk *et al*. 2002).

THE PROGRESSION OF VULNERABILITY FOR LUSAKA INFORMAL SETTLEMENT

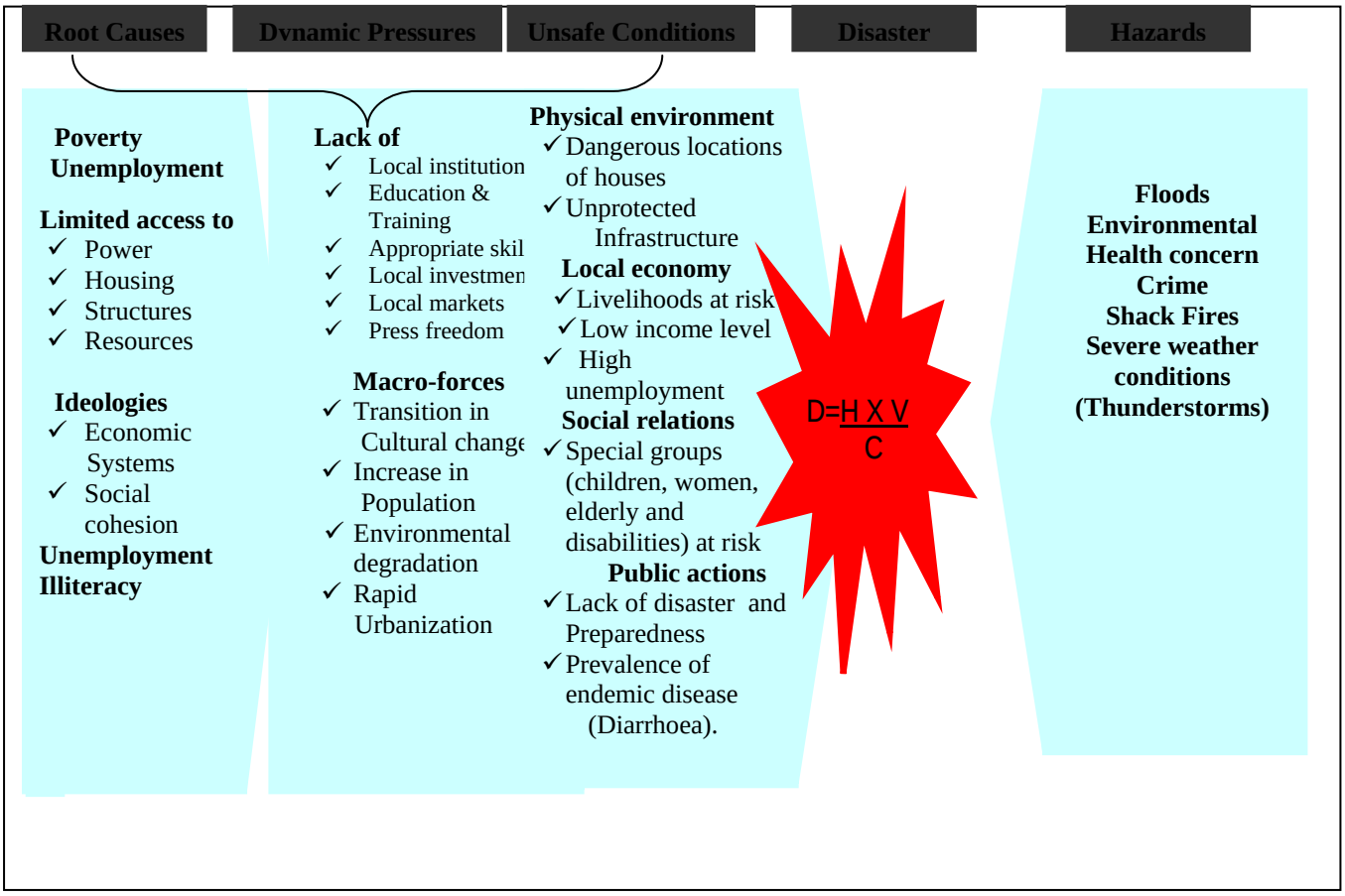


Figure 29: Progression of Vulnerability.

Source: Twigg, 1994

Vulnerability is seen (as indicated in the figure above) as the progression of three phases, namely: Root causes, Dynamic pressures and unsafe conditions:

5.2.1. Root cause

Root causes are defined as a deep-rooted set of factors within a particular community that together form and maintain vulnerability (Twigg, 2007). Judging from the findings of the community based hazard and vulnerability assessment; the Lusaka informal settlement is experiencing a high level of poverty. According to the community leaders and ward committee members, unemployment levels are high with a small percentage of population formally employed. Unemployment could be attributed to insufficient natural resources or strong livelihoods. The main sources of income are the government grants which this community solely depends on for their living. Those with jobs work mostly as labourers on nearby suburbs.

The community experiences poor governance. It becomes difficult for this community to cope since it is vulnerable to most of the identified hazards. The economy of this area is not strong and that is another factor contributing to poverty and vulnerability of the community because of the high rate of unemployment. The following were part of the causing factor of poverty before the democratic era:

- Applied a political structure, which excluded the underprivileged groups (African, Coloured, and Asian) from the political structures, which was based on racially segregated ideologies.
- Focused on sectorally structured infrastructure delivery, which focused on the privileged grouping in society, which was weak on the facilitation of private sector investments.
- The White Paper on Local Government (1998) stated that "Apartheid" has fundamentally damaged the spatial, social and economic environments, in which people live, work, raise families and seek to fulfil their aspirations.

5.2.1.1. Factors that increase fire risks

- *Open flames and paraffin stoves*

Open flames and paraffin stoves are widely used in informal settlements (as indicated in figure 28 below). Technically, these constitute a fire hazard in informal settlements. They are open-flames and paraffin stoves, also cooking, heating and lighting resources for poor families and also that there is no electricity in some of the areas. However, many behavioural and other vulnerability factors increases the likelihood of an endangering fire event. For instance:

Domestic households consume over 700 million litres of paraffin (kerosene) every year in South Africa, for cooking, lighting and heating. Paraffin is the most commonly used fuel source for low-income communities throughout the country and is used in more than half of all South African households. Paraffin is often used in conjunction with other forms of energy such as electricity, coal and wood. The majority of domestic paraffin incidents involve children as they are more likely to mistake paraffin stored in cool-drink bottles for water or cool-drink or be injured in paraffin-related fires (CoT, 2007).

Figure 30: Children playing close to an open fire

Figure 31: Illegal connection of electricity

Both legal and illegal electrical connections are used in informal settlements and each poses risks (as indicated in figure 33 above). With extensions of legal electrical connections for income generation, it is argued that residents with access to electricity 'rent' it by supplying other areas and households which are not connected to electricity network through one plug or power outlet. People who then pay 'rent' for electricity are often required to limit its usage (e.g. TV but not cooking) to avoid tripping the power through overloading the system. Electricity is

accessed by connecting wires that may be strung above the ground, laid on the ground or even placed below the ground. These cables melt when they are overloaded which exposes the cables to children playing in the streets.

Another aspect of increasing fires is the density of the settlement. Although density is not the main cause of fires, it contributes to severe fire risk in several ways:

- Density increases the number of potential ignition sources when there are many cooking and lighting points in a congested settlement.
- Density increases the likelihood of fires spreading easily from one settlement to another.
- Housing density and exposure to low-hanging electrical wires (often called 'spaghetti wires') also limit access for fire fighting and response vehicles.

➢ *Social and behavioural factors*

Physical or structural risk factors are not the only drivers of informal settlement fires. The high incidence of fires on public holidays, weekends and at night suggests important social risk factors. These include:

Alcohol abuse: when people return to their informal dwellings after drinking alcohol at a local shebeen, they often fall asleep while attempting to cook on a paraffin stove or leave a candle burning, both of which can easily start fires.

Domestic violence: angry or jilted lovers can deliberately set fire to their partner's dwelling or that of the person sleeping with their partner.

Inadequate social support: working parents are forced to leave their children unsupervised. Children are often expected to cook for themselves and their siblings, and even very young children use paraffin stoves, light candles and tend to open fires. In the absence of recreational and safe playing spaces, children end up playing around the home, increasing the risk of knocking over a stove or candle and starting a fire.

Low levels of social cohesion: the rapid pace of in-migration and social change in a settlement alter social relations and reduce the degree to which residents know, trust or support each other. This also affects the degree of collective social control over endangering fire behaviour. Important conditions that increase fire risks are summarised below in table 19.

Table 4: Important conditions that increases informal fire risk

General fire risk conditions	Specific fire hazards and vulnerability
Weather-related risk conditions.	Hot, dry, windy conditions. Cold and wet weather conditions (the need for families to keep warm).
Temporal factors	People away from homes during holydays mean fewer people to extinguish blazes. More alcohol consumption during public holydays and weekends. More alcohol consumption when people are being paid.
Regulatory and institutional factors	Unregulated and unplanned growth of informal settlements and resulting shortfalls in service-delivery. Widespread use of illegal electrical connections. Vehicles parked between informal structures create fire bridge especially because car seats are made of polyurethane.
Build environment and infrastructural factors	Flammable building materials, such as wood, plastics, canvas and wall papers. Closely parked structures. Wood, plants, rubbish, waste and debris between structures. Small structures more quickly engulfed in flames. Lack of streets and access routes. Lack of fire hydrants, water must be sourced from another location which creates pressure problems.
Social and behavioural risk factors	Unemployment/underemployment. Alcohol abuse, domestic violence and jealousy in relationships. Lack of social cohesion in rapidly densifying settlement with high levels of in-migration. Inadequate social support networks and limited capacity for working together. Apathy Lack of knowledge about fires. 'Me' and 'mine' emergency response when it comes to protecting assets. Lack of political tolerance.

Source: CoT, 2008

5.2.1.2. Environmental health risks in the Lusaka informal settlement

According to Miller (1992), one of the following factors, or a combination of all, causes environmental problems:

- rapid population growth;
- the wasteful use of resources with too little emphasis on population control and waste reduction;
- the over-simplification and degradation of parts of the earth's life-supporting system;
- poverty, which can drive poor people to use resources for short-term survival and expose the poor to health and other environmental risks; and
- The failure of economic and political systems to encourage sustaining forms of economic development and to discourage earth-degrading economic growth.

Environmental sanitation is more problematic in informal settlements; some often lack public latrines and Lorries for rubbish collection. People living in areas of high population density with inadequate services tend to take environmental issues for granted resulting in problems. A large section of the community in informal settlements come from villages without electricity, pipe-borne water or sanitary services and is struggling for survival (figure 30 below). They also have low expectations of the urban area services (Hardboy and Sattewaiter, 1989).

Figure 32: Waste accumulates close to dwellings

A lack of readily available drinking water, sewerage system connections, garbage collection and basic measures to prevent disease and provide health care ensure that the informal settlements are disease-ridden. Many informal settlements who do not have sewerage systems; rivers, streams and ditches are where most untreated human excrement and household waste water are discharged. Most of these problems are linked to the poorer type of household summarized in Table 5 below (Hardboy and Satterthwaiter, 1989). People in informal settlements often struggle with accessing services such as water, electricity, regular refuse removal and sanitation services. Poverty, lack of knowledge inherent in these areas

often lead to littering, overflow from the poorly maintained or defective sewerage system, as well as unmanaged waste and other sources of land pollution. Dust from gravel or untarred roads, and the lack of toilet facilities and other basic services also aggravate the problem (Mathee and Swart, 2001). Two main factors that increase environmental health risks in Lusaka informal settlement:

- The inadequate provision of basic services,
- Individual and group behaviour that foster unsanitary practices, littering and neglect of infrastructure.

Tables 5 and 6 respectively shows how lack of infrastructural and service delivery and unhelpful individual and group behaviour increase environmental health risks in informal settlements.

Table 5: Environmental health risks: Focus on infrastructural and service delivery risks

Hazards	Vulnerability factors increasing risk	Effects
Stagnant water around taps	Inadequate or blocked drainage systems. Poor maintenance of taps. Large numbers of users.	Health problems, particularly among children who play in water. Missed schools and work days
Stagnant grey water	Inadequate or blocked drainage systems. Inadequate provision for grey water disposal.	Contamination of the environment in and around the settlement Contamination of surface run-off Health problems, particularly children who play in water.
Contaminated water source/water bodies	Inadequate or blocked drainage systems increase the likelihood of contaminated surface run-off flowing into natural water sources. Accumulation of solid waste around and in water sources.	Contamination and downstream environment Disease outbreak and sometimes death among children. Missed schools and work

	Inadequate access to piped water encourages the use of natural water source for bathing and washing clothes. Inadequate toilets facilities.	days.

Source: TIEP, 2007

Table 6: Environmental health risks: Focus on behavioural risk factors

Accumulation of solid wastes	Poorly functioning waste collection and waste removal. Inadequate access to refuse bags. Models of behaviour that tolerate littering.	Contamination of the environment in and around the settlement Contamination of surface run-off. Blockage of drainage systems with solid wastes leading to increased flooding during rainy season. Increased number of disease spreading flies, rats and other vectors.
Unsanitary practices	Accumulation of waste in and around homes. Inadequate facilities to wash hands after visiting the toilets or before handling food. Inadequate knowledge about good hygiene practices. Poor handling of food by suppliers such as informal butcheries. Storage and transportation of water increases chances for contamination.	Disease outbreak (diarrhoea and vomiting) and sometimes death among children. Missed schools and work days.

Source: TIEP, 2007

5.2.2. Dynamic pressures

In this phase there is a translating process that channels the effects of a negative cause into unsafe conditions. This process may be due to lack of access to basic services, provision or it may result from a series of macro-forces (Twigg, 2007). Shortage or lack of local institutions means that there are no possibilities of institutionalizing flood prevention and mitigation in the area. Training facilities are high desirable in this area to educate, transfer skills and knowledge and train community members. Lack of relevant skills and recourses in dealing with hazards is highly needed. For example, community members should have skills in basic fire fighting and first aid courses and also the awareness of basic disaster management issues. Secondary factors, which also influenced this decision, are the sub-standard provision of education and health services and the poor delivery of infrastructure and essential services such as water, electricity and sanitation (CoT, 2008).

The substantial increase in population means that the resources that are available will be depleted and thus increases the vulnerability of Lusaka community. The absence of sanitation, refuse and waste removal and electricity (as a source of energy) makes it difficult for this community, since it has to depend on firewood collected from the veld and mountains. Collecting firewood has adverse effects on the environment (e.g. soil erosion) and thus causes health complication such as illness like asthma, TB, diarrhoea and etc (CoT, 2008).

The inhabitants of this informal settlement experience the effect of dynamic pressures as the residents are now, because of rapid urbanization and transition in cultural practices, forced to live in sub-standard conditions that contribute to the lack of basic essential services, inadequate housing and education, a lack of skills development opportunities as well as limited employment (job opportunities) offered in the City of Tshwane. The rapid urban growth has a negative impact on the environment, which again leads to the degradation of certain wetlands, river basins and ground water resources in the City Tshwane. The causal factor of this degradation is pollution caused by inadequate waste removal, poor sanitation and drainage systems. The above, plus the inadequate provision of clean water, also contributed to human health problems (CoT, 2007).

5.2.3. Unsafe conditions

This phase discusses the vulnerable context where people and property are exposed to the risk of disaster. The fragile physical environment is the focal issue. The shelters are built in such a

way that they are closely packed and that becomes a high risk when a hazard like fire occurs. This community is located in an area where they are in a flood line area and that increases its vulnerability. The majority of the members of the community earn low salaries. The building infrastructures are poorly constructed and could consequently be vulnerable to floods (CoT, 2007).

There are 18 576 informal structures identified which are at risk of possible flooding. Approximately more than 7 000 of these structures are regarded to be at high risk of flooding because they are below the flood lines or else situated within flood retention dams/river lines (CoT, 2007). These high-risk areas are mostly not suitable for human occupation and are and occupied illegally. Most of the informal dwellings are mainly constructed from highly flammable and combustible material i.e. corrugated iron, wooden planks/poles as well as plastic sheeting. It is reported by the TIEP (2007) that there are no building codes that guide the type of materials to be utilized, as most of these informal settlements (shacks) are classified as illegal (TIEP, 2007).

The lack of essential services also decreases the level of safety as residents are forced to cook with open flames using paraffin and candles for heating and lighting purposes. The high density of shacks in the overcrowded informal settlements, increase the fire risk and restrict the access of emergency vehicles to these areas, and escape routes for residents are very limited (CoT, 2007). This community is vulnerable to most of the hazards that have the potential of disrupting their normal daily activities. Most of the members earning low income levels have difficulties in providing for their families and building proper houses. This community lacks disaster management awareness and training pre and post disaster (TIEP, 2007).

The worst health conditions found in informal settlements areas and relatively high growth in these informal settlement areas implies an increased burden on health services. The increasing incidence of HIV/AIDS not only threatens health, but also has negative consequences for both economic development and social welfare (CoT, 2006). The environmental health issues are also critical. Communicable diseases such as Hepatitis, Meningococcal Meningitis and Measles are very high in occurrence and the incidence of Hepatitis and Meningitis in Tshwane (CoT, 2005).

5.3. LUSAKA INFORMAL SETTLEMENT HAZARD IDENTIFICATION

The section highlights hazard identification in the Lusaka informal settlement. The community is assessed for vulnerability to various hazards and this section will provide solutions to address the identified hazards. Only the first three (3) prioritized hazards (i.e. floods, environmental health concern and shack fires) will be discussed in detail and the remaining hazards will be mentioned only.

When a hazard results in great suffering (with which the local services can't deal with), it is termed a disaster (CoT, 2007). The first step in any risk assessment is to identify and prioritise the hazards. The City of Tshwane is exposed to a number of hazards, those ranging from natural hazards like floods, and thunderstorm to human-made hazards such as fire/veld fires. Other hazards include environmental health concern, major accidents *(*CoT*,* 2007).

5.3.1. Risk hazard profile in terms of priority according to severity

The hazard risks within Ward 10 are primarily linked to flooding and shack fires. Other disaster risks include veld fires, severe weather conditions and environmental health.

Table 7*:* Prioritised hazards of Lusaka informal settlement

Serial No	Hazards	Low Risk (LR)	Medium Risk (MR)	High Risk (HR)	Priority
1.	Floods: Flash floods River floods			✓	1
2.	Environmental health concern			✓	2
3.	Shack fires			✓	3
4.	Crime		✓		4
5.	Severe weather conditions		✓		5
6.	Veld fires		✓		6

5.3.2. Hazard approach for Lusaka informal settlement

Hazards are potentially damaging physical events and/or human activities that may cause the loss of life or injury, property damage, social and economic disruption, or environmental degradation. Hazards are characterized by location, duration, magnitude and timing (UN, 2007). They can include latent conditions that may grow or contribute to future events and can

have different origins: natural (geological, hydro-meteorological and biological) and /or induced by human processes (environmental degradation and technological hazards). A potential damaging phenomena (hazard) only has the potential of becoming a disaster event when it occurs in populated areas where it can cause loss of life or major economic losses (Allen, 1992). Each hazard is characterized by its location, strength, frequency, time evolution, and probability of occurrence. According the UN (2007), the strength of a hazard is measured in terms of its magnitude, intensity or toxicity. The frequency is measured in terms of its probability of occurrence, also called period of return (high probability, low probability or continuous) (UN, 2007). Each hazard type has a different rapidity of onset, for example; sudden, or rapid slow onset and continuous.

5.3.2.1. Natural hazards

In many poor countries development is repeatedly interrupted by natural disasters such as floods, thunderstorm and drought. Natural disasters can lead to an increase in poverty and can retard human development. It is also the poor that are normally worst affected, decreasing their chances further of dragging themselves out of the clutches of poverty (World Bank, 2000). The identification of hazards and vulnerability assessment of natural hazards in Lusaka informal settlement is therefore extremely important in order to put risk reduction strategies in place. If the impacts of natural hazards on local communities are not substantially reduced or prevented, it will be impossible to achieve Sustainable Development.

5.3.2.2. Hazard identification and assessment

- *Floods*

The hazard assessment is the first phase of the disaster risk and vulnerability assessment process, and the focus is mainly on identified natural and human induced hazard events which have occurred in Lusaka informal settlement within the CoT in the past. The identified natural hazards in Lusaka informal settlement are floods and severe weather conditions (thunderstorm). A flood hazard assessment can be executed by using the velocity of the floodwater in combination with the depth of inundation. The following figure (Figure 31) illustrates the basic methodology used for the execution of a flood hazard assessment. Given the velocity and depth of floodwaters it is possible to identify low, medium, high and excessive hazard areas (Booysen, 2001).

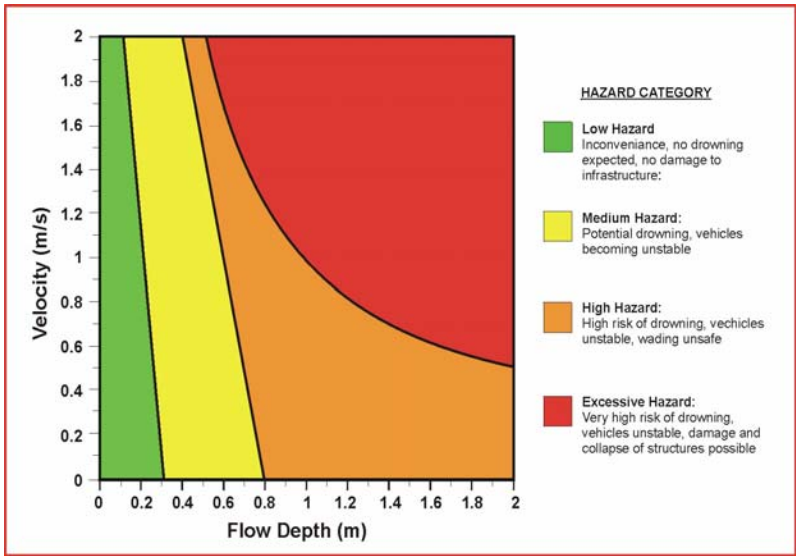


Figure 3: Flood hazard assessment

Source: Booysen, 2001

The survey findings of the community-based hazard and vulnerability assessment for Lusaka informal settlement indicated that 88% of the priority hazards were floods, health problems, fires, and thunderstorms. Two (2) of the five (6) disaster hazards which were identified by the community of Lusaka informal settlement have been weather related and four (4) of the events were declared as human-induced hazards. The outcome of this study has indicated that fires (structural), hydro-meteorological (including thunderstorms and floods), physical (crime) as well as biological (health concern) feature as prominent priorities.

Although the community-based hazard and vulnerability assessment did not include the whole cycle of the phases of risk assessment process, it highlighted the vulnerable communities (informal settlement residents), which are most at risk to disasters. The informal settlements in the City of Tshwane are largely the product of unplanned urban development, which have resulted in many of these settlements to be established in areas defined as hazardous such as on Lusaka, Plastic view, and Brazzaville informal settlements, which are situated underneath electrical power lines, in flood line area, in the areas near sewage culverts and in areas with no access to resources such as water, sanitation, toilets and road infrastructure. Figure 31 illustrates that the level of hazard increases with an increase in velocity and depth of inundation. This shows that loss of life and damage to infrastructure becomes more likely as flooding becomes deeper and flow becomes stronger (Booysen, 2001). Using the hazard assessment it is then possible to execute a risk assessment by evaluating existing land use types in the hazard areas.

A flood is a normal event for any river or stream that could occur over a period of time varying from several times a year to once every few hundred years. Floods are caused when excess water from heavy rainfall, snowmelt or storm surge accumulates and overflows the river or stream's normal path onto its banks and adjacent floodplains (Miller, 1997). Several factors determine the severity of floods, including rainfall intensity and duration. A large amount of rainfall in a short time span can cause flash flooding. A small amount of rain can also cause flooding if the soil is saturated from a previous wet period, or if the rain is concentrated in areas where the surface is impermeable, such as in developed areas where most of the surface is covered with concrete, tar and other building materials (FEMA, 1997).

Figure 34: Flooded area in Lusaka
Source: CoT, 2008

Rainfall in Tshwane is seasonal with most of the precipitation received in the summer season (September to March). Rainfall can be very erratic and variable at times, causing occasional periods of 4-47 extreme wet or dry conditions. Average rainfall varies from 575mm in the south to around 725mm in the Tshwane (Van den Berg and Manley, 2002). Wet months in CoT are between September to February, and these months are dominated by relatively high rainfall, high temperature and high relative humidity, not suited to large veld fire events (CoT, 2007). Topography and groundcover are also contributing factors for floods. Water runoff is higher in areas with a steep slope and low vegetation density (extension 18 & 22 in ward 10). Urbanization of floodplains and manipulation of stream channels have increased both the frequency and magnitude of floods in many areas of Tshwane (CoT, 2007). Floods are most common in the season of highest precipitation (Miller, 1997). Medium flood risk can be found along the banks of the eastern tributary of the Hartebeespruit River in Lusaka informal settlement. There seems to be significant overlap between areas with flood line priority and developed residential areas, implying that people and infrastructure are at risk (CoT, 2007).

Figure 35: Ponding in and around the houses of Lusaka

Source: CoT, 2008

Figure 36*:* Flooded house in one of the Lusaka household

Source: CoT, 2008

Figure 37: Drains clogged by waste on the stream Lusaka

Source: CoT, 2008

Figure 38: Informal homes on the edge of a river in Lusaka

Source: CoT, 2008

Figure 36 above shows the informal settlement built along side the streams/ river floodplains are lowlands adjacent to rivers or streams that are subject to recurring floods. The potential volume of water that could reach the floodplain is a function of the size of the contributing watershed and topographic characteristics such as watershed slope and shape, and climatic and land use characteristics (Coch, 1992).

- *Types of flooding*

Flooding in the City of Tshwane is historically associated with the rainy summer season between September and January. However, changing weather patterns mean that heavy rainfalls can also occur at other times of the year. The CoT is exposed to many flood risks such as riverine and flesh floods and ponding flooding. However, in the case of Lusaka informal settlements and other poor, under-serviced informal settlements, the term 'flooding' also includes other risk conditions such as the following:

Table 8: Types of flooding in City of Tshwane

Types of flooding	Why this is important
Riverine and estuarine flooding	Storms or rains raise water in rivers, lakes and estuaries. Riverine flooding can also take the form of flash floods, where intense storms produce fast-flowing but short-lived floods.
Ponding	Rain lies or stands on the surface of the ground for days or weeks in poorly –drained, low-lying areas.

Surface run-off	Water drains off surface, particularly hardened surface such as tarred roads without adequate storm water drainage, or runs down steep slopes.
Leaking	Rainwater leads to inside flooding through poorly constructed and inadequately flood-proofed structures, often due to roofing and walls that cannot handle heavy rainfalls.

Source: CoT, 2008

- *The sources of floods in Tshwane*

The following are the sources of floods in CoT:

Table 9: Sources of floods in Tshwane

Source of hazard	Hazard	Factors increasing risk	Effects
Poor drainage system	Ponding	o Poor drainage around communal water taps o Shallow, hand dugs informal drains between houses o Blocked drains o Clogged drainage ditches	o Health of people, children playing in dirty water will conduct diarrhoea and other water-borne diseases. (Typhoid disease) o Missed work days and schools due to flooded areas.
	Surface run-off	o Inadequate drainage along side roads o Structures in close proximity with the roads. o Storm-water drains and drainage ditches that are blocked by litter and other households waste o Lack of toilets, especially in heavy rains	o Health of people, children playing in dirty water will conduct diarrhoea and other water-borne diseases. (Typhoid disease) o Missed schools or work days o Damage to infrastructures. o Loss of assets and

			possessions. o Ill health, especially children and damage to property. o Human waste that contaminates standing and drinking water.
Structural problems	Seepage	o Structures in close proximity with lakes or streams. o Home foundations below ground level. o Poor building materials.	o Damage to and loss of assets and possessions. o Health of people, children playing in dirty water will conduct diarrhoea and other water-borne diseases. (Typhoid disease) o Missed schools or work days.
Flood exposure factor due to location and surrounding	Riverine flooding	Structures in close proximity with the river or streams. Disturbance of natural water drainage and flow patterns.	o Isolation of communities as bridges and roads are damaged and washed away. o Injuries, deaths and related costs. o Homes completely washed away.

Source: CoT, 2008

5.3.2.3. Vulnerability assessment for floods

The poor communities often live in more vulnerable structures and settlements and suffer as a result, disproportionate rates of mortality and injury. Vulnerability is heavily conditioned by gender and age, and from context to context, the most vulnerable may be women, children and the elderly. The National Water Act (Act 38 of 1998) states: "…no person may establish a

township unless the layout plan shows, in a form acceptable to the local authority concerned, lines indicating the maximum level likely to be reached by floodwaters on average once in 100 years". Although the Water Act (Act 38 of 1998) requires that flood lines should be demarcated before a development is approved, it was therefore impossible to remove the residents of Lusaka settlement from the flood prone area. As floods are regarded as a major potential source of a natural disaster, the researcher and the community of Lusaka settlement concluded that risk reduction strategies should be developed. The impact of a flood is more severe on a more densely populated informal settlement like Lusaka.

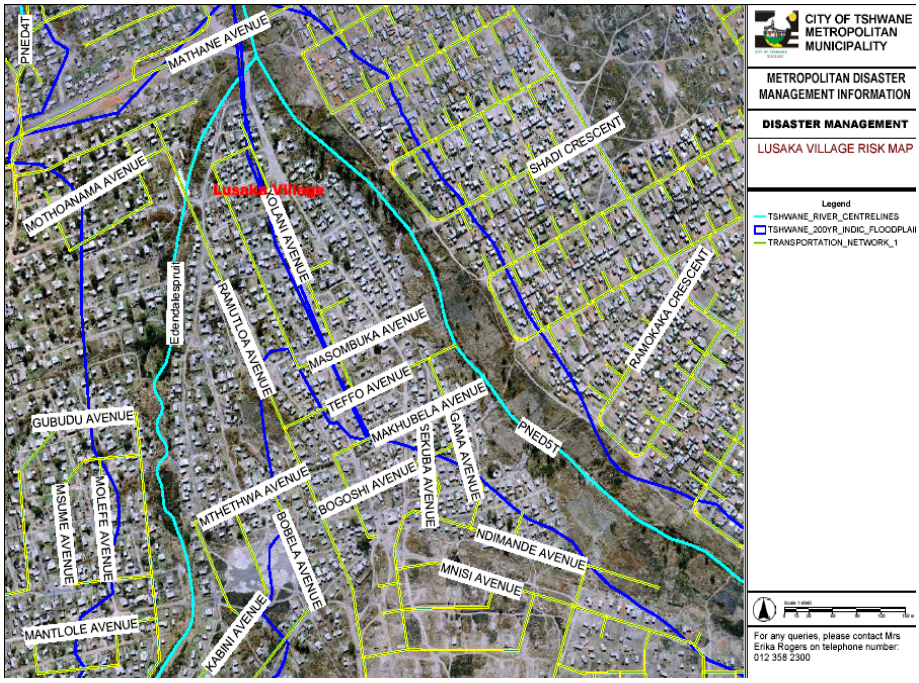


Figure 39: Tshwane vulnerability Flood line, CoT. 2007

In case of the mitigation strategy in reducing flood damage, the community based approach can be followed where the community will be able to identify their own hazards and vulnerabilities hence they come up with risk reduction measures to prevent and/or reduce the disaster risks. The community will then prioritise these settlements according to vulnerability. This method should give an indication of the order in which detailed community based hazard and vulnerability should be performed and thereby give Disaster Management practitioners some guidelines regarding their budget planning.

For Disaster Management centre to compile appropriate flood prevention and mitigation strategies, better quality flood and land use information should be generated. In order to prioritise risk areas it is necessary to predict the possibility of loss of life and calculate potential

damage to infrastructure. This information could be used to perform community based hazard and vulnerability assessments that would provide the CoT Disaster Management centre with the information needed for effective floodplain management planning and preparedness.

5.3.3. Human-induced hazards

5.3.3.1. Hazard identification according to their priority

The following are the three identified human-induced or man-made hazards:

- Environmental health concern
- Shack fires
- Crime
- Veld fires

➢ Environmental health concern

Environmental health refers to the health of the everyday environment in which people live (e.g. wastes, pollution. The health of an environment is affected by how people live, eat, wash, produce solid waste and go to the toilet, as well as by the systems in place to manage the waste generated by human communities. Good environmental health means that management infrastructure and services are appropriate and affordable to users. Unfortunately, rapid urbanization in many parts of the CoT has reduced the levels of environmental health, particularly in unplanned informal settlements, where residents have little or no access to municipal services. Planned urban settlements also face problems, as the provision of water and sanitation facilities lags far behind urban population growth (CoT, 2005).

Figure 40: Accumulation of water around a poorly maintained community tap

For poor households, low incomes and a lack of secure land tenure discourage community from improving the safety of their homes and the sanitary conditions of their immediate

surroundings. On the other hand, contaminated food and water and poor hygiene associated with poor urban living conditions contribute to childhood malnutrition and diarrhea, as well as infant death rates. The cause of pollution in Lusaka lies in the prevailing lifestyles of the residents in the shacks alongside the river (see figure 39 below). Pollution, in the case of all residential areas, occurs when the contents of sewers overflow during heavy rain showers.

Figure 41: Blocked drains in Lusaka.

5.3.3.2. Vulnerability assessment for environmental health concern

The unplanned high population density of Lusaka has overloaded the infrastructure, such that water pressure is low, and the streams frequently gets blocked and overflows. Maintenance of such systems is very difficult because the high densities and congested nature of the backyard shack developments make access for maintenance difficult and impossible in some places (CoT, 2005). The environmental and living conditions in this area are unsatisfactory. There are a number of environmental problems such as water pollution, inadequate sewerage systems and land pollution due to high rates of littering in Lusaka. The poor provision of sanitation services has led to overflowing and leaking sewerage pipes and the dumping of raw sewerage in the river. As a result, there is an unpleasant smell around the area (Barnes *et al*, 2001).

This situation arose from the disparities in service provision on account to the policy of the separate development. The shortage of safe drinking water is due to the high pollution levels in the river, and the inability of shack dwellers to pay for water and other services. There is also a shortage of proper sanitation services, and the authorities lack the capacity to cope with the demand (CoT, 2007). The impact from the afore-mentioned factors is that the lack of effective and decent sanitary facilities and clean water increases susceptibility to disease. Inadequate sanitary conditions, safe drinking water and limited access to health facilities result in worse

living conditions. Inadequate heath facilities are associated with a higher prevalence of diseases and subsequent poverty, if the breadwinner in the lower income groups should succumb (Itano, 2001).

Table 10: Environmental health challenges in Lusaka informal settlement

Specific environmental health challenges	Why this is important
Water supply points	Heavily burden water points are frequently shared by many people, but are not used properly. They are poorly maintained and often broken.
Grey water disposal	There is inadequate or absent capacity to dispose of waste water. This results in domestic grey water ending up as used, dirty water that contaminates the environment.
Sanitation systems	Not all sections in Lusaka have toilets facilities. In those that do, the facilities are often improperly used, overburdened and are infrequently maintained and services.
Storm-water drainage	Run-off that is not drained away from houses, roads and pathways mixes with contaminated waste water, sewage and waste, polluting the local and surrounding environment, and natural water sources.
Health services	Primary healthcare facilities in many parts of CoT are overstretched. Health workers have insufficient time and capacity to provide community level education about preventable contaminated illness, such as diarrhoea.
Environmental health inspection	For the same reasons, environmental health inspection, monitoring and reporting of poor service provision is also inadequate. Environmental health officers are often seriously overstretched and lack the time or capacity to monitor conditions in Lusaka.

Source: TIEP, 2007

- *Shack (structural) fires*

Shack (Informal settlement) fires constitute a serious disaster risk in the CoT. These occur primarily within informal settlements. Fire risk often has a temporal component: fires may be

most common in the dry, windy winter months (may to August), over holidays when people are away from home, over weekends or at the end of the month when people are more likely to socialize and consume alcohol (CoT, 2007). As with flooding, shack fires result from the interaction of environmental and human factors. The hot, dry and windy summer and winter conditions in many parts of the province create the ideal environment for fires to spread, but most endangering fires are started by people. There is never any one single risk factor – but a combination of weather, institutional, infrastructural, social, and temporal (i.e. time of day, week, month, year) conditions can converge to result in destructive fire events (CoT, 2007). The significantly increased severity of informal fires over weekends and late at night or early in the morning is attributed in part to compromised levels of individual responsibility due to alcohol consumption.

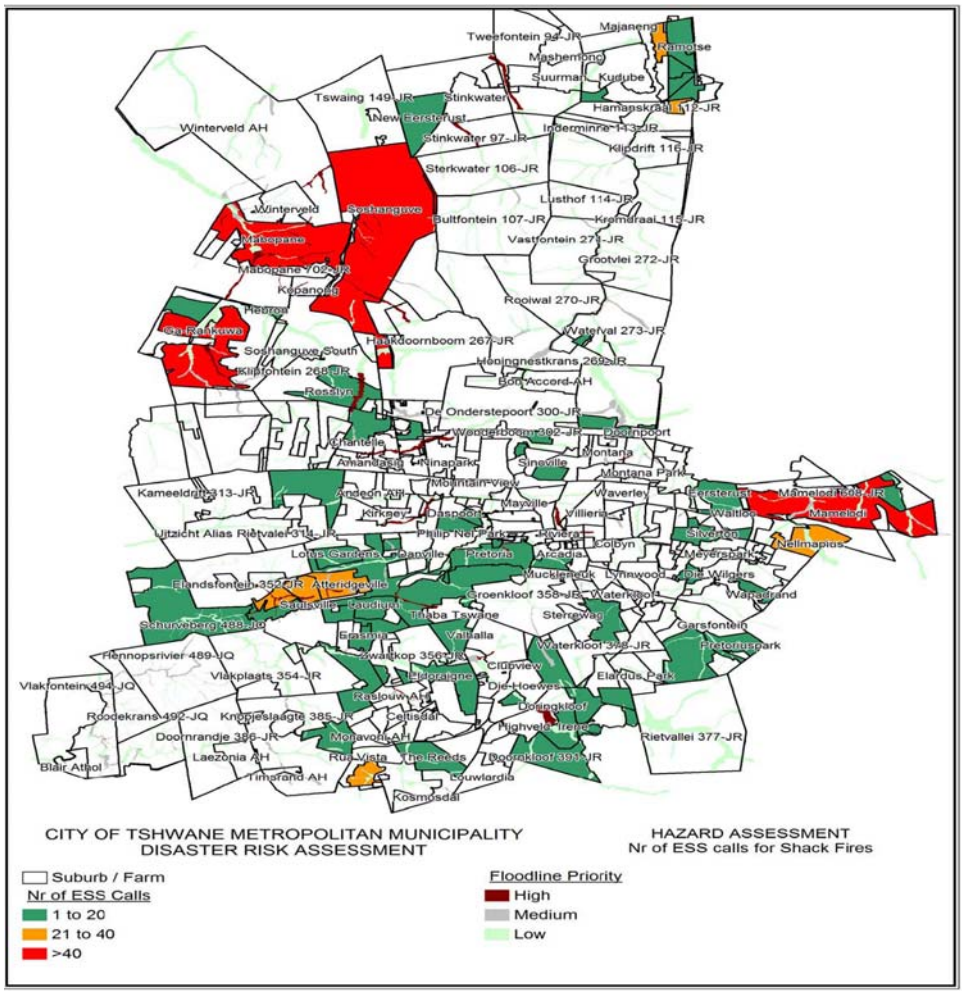


Figure 42: Shack fires ESS calls in Lusaka.

Source: CoT, 2007.

5.3.3.3. Vulnerability assessment for informal fires

The Fire Brigade Services Division of the City of Tshwane (CoT, 2007) confirmed the high rate of fire incidents in the CoT informal settlement areas. From 2003 to 2007 (5 year period), a total of 5874 fire incidents in the informal settlement areas were recorded. This figure amounts to an average of 1174, 8 incidents per year. These statistics only registers the number of fire incidents where the CoT Fire Brigade Service has attended to in informal settlement areas. (The extent of the incidents and the number of persons affected were not calculated in these statistics). In the case of the CoT it was then decided to identify the dry months of May and August as the months that hold the greatest risk of shack fires, based on the 4-49 relatively high potential of the community warming themselves and their families. According to local community/residents, these months are also prone to strong winds that could accelerate the spread of fire to other informal houses. People can be vulnerable to fire hazards such as:

- when paraffin is contaminated with fuel with a lower flash point that may increase fire threat,
- when candles are unattended by a competent adult or poorly managed by children, and
- When there is high usage of illegal and overloaded electrical connections or spaghetti wires.

According to Wisner (2003), domestic households consume over 700 million litres of paraffin (kerosene) every year in South Africa for cooking, lighting and heating. Paraffin is the most commonly used fuel source for low-income communities throughout the country and is used in over half of all South African homes. Paraffin is often used in conjunction with other forms of energy such as electricity, coal and wood. The majority of domestic paraffin incidents involve children as they are more likely to mistake paraffin stored in cool-drink bottles for water or cool-drink or be injured in paraffin-related fires.

5.4. SUMMARY

The findings of the research were discussed and analysed using the application of progression of vulnerability to assist in identifying the root cause of the problems experienced in Lusaka informal settlement. The progression of vulnerability model was applied in the practical assessment of vulnerability and the crunch model depicts that the progression of vulnerability plays an integral part in understanding the impact of the disaster on a community. The “PAR”

model as applied for Lusaka informal settlement within the City of Tshwane has indicated that people residing in the informal settlement areas are subjected to the following aspects, which make them vulnerable to disasters:

- High prevalence of poverty and a lack of access to economic, social, health, education and safety and security structures.
- Lack of access to basic utility systems such as water, electricity, sanitation and waste removal.
- Unsafe living conditions, as most of the informal settlements are situated in high-risk areas, which are not suitable for human occupation.
- The dwellings the people reside in are mostly constructed from highly flammable material.
- The informal areas are on a regular basis subjected to hazards such as fires and floods.

From the analysis and discussion of the results, it is clear that the community-based hazard and vulnerability assessment has proven to be the best way of conducting risk assessment process as it rooted out all the problems, concerns and vulnerabilities of the community, including the actual root causes and dynamic pressures within the Lusaka informal settlement. The community of Lusaka also seems to be lacking knowledge of disaster management and their level of literacy also perceived to be low. The progression of vulnerability assessment has now provided a foundation from where all the negative aspects normally associated with informal settlement areas, are identified. These negative aspects, which cause communities to be vulnerable to disasters, are discussed in the next chapter where the “Progression of Safety” model will be applied as the solution to the identified root causes and problems.

Although the community-based hazard and vulnerability assessment did not include the whole cycle of the phases of risk assessment process, it highlighted the vulnerable communities (informal settlement residents), which are most at risk to disasters. The informal settlements in the CoT are largely the product of unplanned urban development, which have resulted in many of these settlements to be established in areas defined as hazardous such as on Lusaka, Phomolong, Plastic view, Itereleng and Brazzaville, which are situated underneath electrical power lines, in flood line area, in the dolomite areas or near sewage culverts and in areas with no access to resources such as water, sanitation, toilets and road infrastructure. Urban planning in South Africa can help contribute to disaster risk reduction by strengthening local

resources in the community and attaining external resources that are not available in the community, promoting personal empowerment and livelihood improvement training that increases knowledge and skills to build a culture of safety and resilience. Planning could also adapt measures that include public awareness, good land use planning methods, well-enforced building codes, structural and non-structural measures, hazard assessment, disaster planning, early warning systems, resource planning and the discussion of inter-jurisdictional issues that affect the community. Communication and information within the local structures that address issues relevant to disaster resilience within the communities' context could also help reduce the risk to disasters. However, people should be able to minimize the impacts of disasters regardless of their economical, social, physical and political structures, hence it is of great importance for residents to have social capital that promotes income-generating activities to improve the financial status of the community, build long-term social protection and investment before disasters strikes.

CHAPTER SIX:

COMMUNITY BASED DISASTER RISK MANAGEMENT FRAMEWORK

6.1. INTRODUCTION

This chapter gives the detailed insight discussion and background in the progression of vulnerability and it also outlines the community approach framework. With the aid of progression of safety model, control measures will be identified to address hazards that make Lusaka informal settlement community more susceptible. Community-based disaster risk management provides a systematic process for identifying, estimating, and ranking community risks (APDC, 2003).

Chapter six (6) which entails Community-based disaster risk management (CBDRM), is anchored in the disaster risk reduction framework, thus this framework will cover a broad range of interventions, measures, activities, projects and programs to reduce disaster risks which are primarily designed by people in at-risk localities (in this case, Lusaka informal settlement and other related informal settlements within the COT) and are based on their urgent needs and capacities (ADPC, 2003). Through CBDRM, vulnerable groups and communities can be transformed to disaster resilient communities which can withstand and recover from stresses and shocks from the natural/physical and socio-economic, political or environment (ADPC, 2003).

In order to conduct a community-based hazard and vulnerability assessment framework, this chapter will focus on the following aspects:

- Provide a profile of the City of Tshwane, Lusaka informal settlement which will serve as a case study for the community based hazard and vulnerability assessment process in this chapter;
- Discuss the “Progression of safety” model as proposed in Chapter five (5) through the application of progression of vulnerability model; and
- Development of community-based hazard and vulnerability assessment framework;
- Integrate the investigation of the semi-structured interviews and focus group discussions which were conducted with disaster management officials.

Chapter six aims to achieve the development of a community-based hazard and vulnerability framework, which will assist the community of Lusaka informal settlement to develop their own strategies and mitigation measures.

The chapter also addresses the problems identified in the progression of vulnerability. The control measures are recommended to reduce the disaster risk in Lusaka informal settlement. The implementation of this control measures will help the (Lusaka) community to be placed in safe conditions. The progression of safety model will be used to explain how to achieve safe conditions for the Lusaka informal settlement community.

6.2. COMMUNITY BASED DISASTER RISK MANAGEMENT FRAMEWORK

The notion of the development of the CBDRM framework is very important, as it allows facilitators to enter into the social life of the community and start to build participatory processes from the inside. In the CBDRM Process, a thorough assessment of the community's hazard exposure and analysis of their vulnerabilities as well as capacities is the basis for activities, projects and programs to reduce disaster risks (ISDR, 2003).

The community should be involved in the process of assessment, planning and implementation. There are more livelihoods in which problems will be addressed with appropriate interventions, through this process. The CBDRM process has seven sequential stages, which can be executed before the occurrence of a disaster, or after one has happened, to reduce future risks. Each stage grows out of the preceding stage and leads to further action. Together, the sequence can build up a planning and implementation system, which can become a powerful disaster risk management tool (ADPC, 2003). This framework is summarised below:

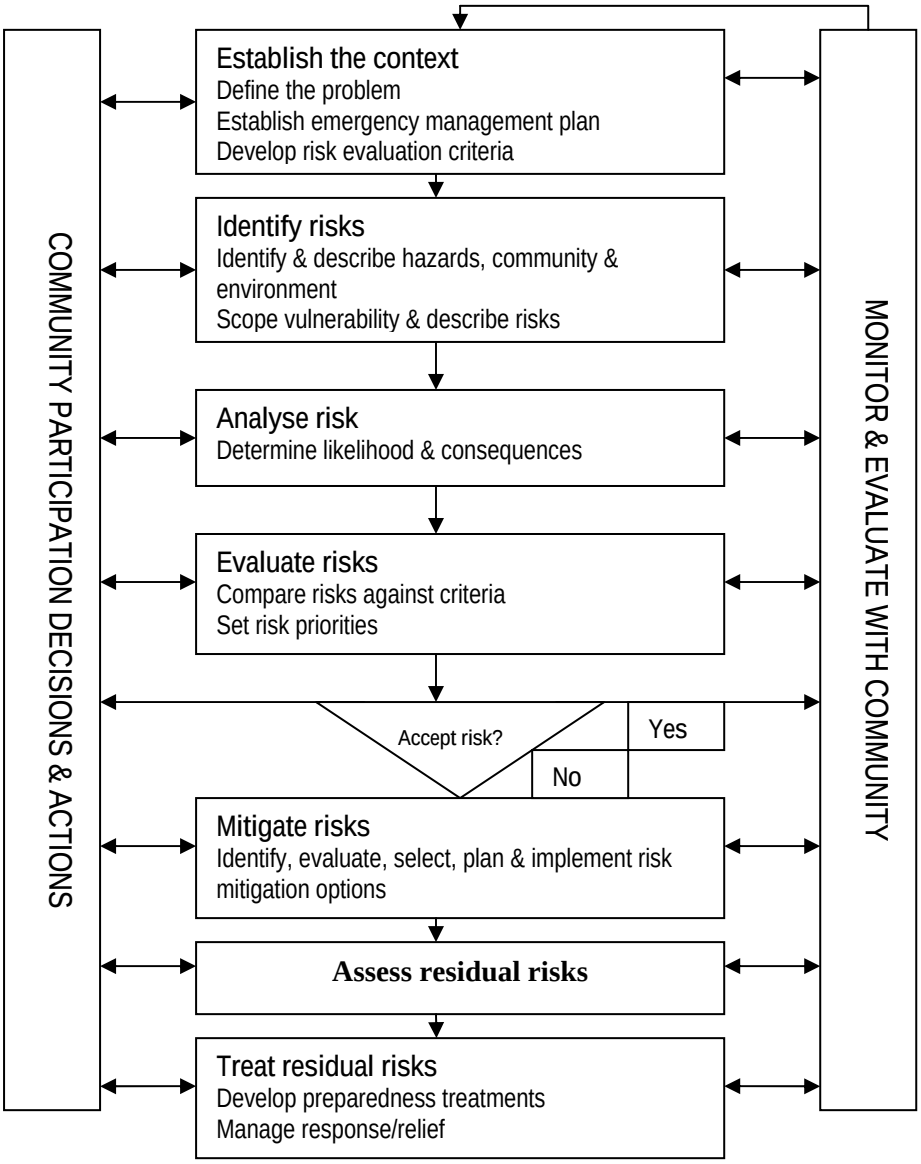


Figure 43*:* The community-based disaster risk management framework

Sources: Twigg, 2001; APDC, 2003 & Twigg, 2007.

According to Twigg (2001), CBDRM emerged as an alternative to top-down approach during the 1980s and 1990s. Over the past two decades it has become apparent that top-down approaches fail to address the needs of vulnerable communities, often ignoring local capacities and resources. The top-down approach can increase vulnerabilities and undermine the quality of life, security and resiliency (Twigg, 2001).

This framework aims at achieving community-based disaster risk reduction, sustainable development and poverty reduction, people empowerment and equity within the community. The CBDRM is also envisioned as an integral component of sustainable development, since it helps in avoiding the negative impacts of disasters on development at the community level

(ADPC 2004). Furthermore, the CBDRM framework will highlights the following principles: Views on CBDRM, Understanding the CBDRM and CBDRM and Corrective actions towards community approach.

6.2.1. The benefits of community based disaster risk management

According to Shaw and Okazaki (2004) one of many benefits of community based disaster risk reduction (CBDRR) that is addressed by the United Nations International Decade for Disaster Reduction (UN-IDNDR) is that community participation will positively address the local socio-economic concerns in disaster reduction by empowering the community with knowledge and skills, develop the leadership capability of the community members and further strengthen their capacity to contribute to development initiatives. The process is about capacity building and community empowerment for improving the community capacity in reducing their vulnerability against natural hazard (Shaw and Okazaki, 2004).

Recognizing the need for vulnerability reduction for effective disaster risk management failures of a top down management approach becomes evident. This approach was unsuccessful in addressing the needs of vulnerable communities (ADPC, 2002). Also better understanding of disasters and losses brings to light the fact that an increase in occurrence of disasters and disaster related loss is due to the exponential increase in occurrence of small and medium scale disasters. The bottom-up approach in dealing with these occurrences has received wide acceptance because considered communities are the best judges of their own vulnerability and can make the best decisions regarding their well being (ADPC, 2002).

Through CBDRM vulnerable groups and communities can be transformed to disaster resilient communities, which can withstand and recover from stresses and shocks from the natural/physical and socio-economic political environment (Bollin, 2003). Regarding community participation, it is important to note that, despite the fact that such involvement may vary from one place to another, participating communities share several characteristics, as noted by Reid (2000):

- In engaging the communities, many people are involved in the community's activities;
- The CBDRM is open to involvement by all groups, and responsibilities are divided up so that the special talents and interests of contributing organisations are engaged. Powers and responsibilities are decentralized;

- Participating communities conduct and publicize their business openly. Citizens are well-informed about the community's work and their opportunities for personal involvement in meaningful roles;
- There is no such thing as a bad idea. All ideas are treated with respect and welcomed as a source of inspiration with potential value for the entire community. This is also achieved by encouraging communities to offer their best for the common goal.
- Engaging the communities makes no distinctions among various groups and types of personalities who offer to be involved. All people are welcomed, regardless of their colour, age, race, prior community involvement, levels of education, occupation, personal reputation, disabilities, religion or any other factor. Participating communities realize that past discrimination and other factors can stop them from moving forward, and they, reach out actively to all citizens to encourage their participation; and
- Participating communities operate openly and with an open mind. They are not controlled by any single organization, group or philosophy, and their leadership is used to facilitate the discussion of a diversity of viewpoints, rather than advocating a parochial agenda.

These characteristics are all relevant to the study, as they are central to achieving effective CBDRM framework within the community of Lusaka informal settlement. Community-based disaster risk management provides a systematic process for identifying, estimating, and ranking community risks. CBDRM further contributes to the community's awareness about potential risks. CBDRM is an essential precursor to a bottom up decision making process for development policies, strategies, plans, programs and projects in disaster risk reduction. More specifically they help to (ADPC, 2000):

- Prioritize community's risks which need to be reduced. The community has to address all its disaster risks but its actions and resources can be prioritized based on the frequency, extent of damage and other considerations which the community members decide on;
- Unites the community in a common understanding of their disaster risk – hazards, vulnerabilities and capacities;
- ensure that the risk reduction is going to be adequate and appropriate;
- Basis for identifying appropriate and adequate risk reduction measures;
- Ensure that risk reduction will be cost effective and sustainable. In many situations, the viable track to reduce vulnerabilities is through increasing the community's capacities;

- have a yardstick to assess if the community is succeeding in reducing risk;
- Contributes to community awareness raising potential risks they did not know about before; and
- Baseline data on the community situation, its vulnerabilities and capacities when compared with data at a later period can be used to evaluate the results of the community disaster preparedness activities (ADPC, 2000).

6.2.2. Corrective actions

Recognizing that risk is best managed in advance and at the local level, the City of Tshwane Disaster Management Centre supported a new approach to community based disaster risk management that was grounded in community participation. According to the Yokohoma Strategy and Plan for Action for a Safer World (1994), "Preventive measures are most effective when they involve participation at all levels from the local community through the national government to the regional and international level". According to Twigg (2001), preventive measures fail because the role-players involved in long-terms sustainable development programmes work in silos. This led to adopting and implementing the concept of community-based disaster risk management. It is an approach that relies on the capacity of the community to remedy their disaster situation themselves and to help each other (Heijmans & Victoria 2001).

Twigg (2004) makes a valuable contribution to risk reduction measures in urban areas by distinguishing between 'private' and 'public' space. According to him, urban residents may be willing to participate in risk reduction activities to protect their own homes, but may feel that 'public space' like drains, roads etc is the responsibility of the local government. The attitude and view of the community with regards to local government responsibility can therefore hamper or enhance community involvement in risk reduction activities.

Things that can go wrong during the implementation of the community-base disaster risk management:

The wrong answers - Preventive land-use plans; which take natural disaster impacts into account in defining land uses and in particular in designating land as unsafe for development, are the most powerful tools for disaster prevention. However, as is widely acknowledged in municipal development studies, plans are not enough. Frequently the land set aside as off-

limits becomes a site for informal settlements and others who cannot afford the costs of living in planned developments (UNDP, 2002).

Therefore, preventive plans must be accompanied by an effective local system of enforcement if they are to work, and the best systems rely on community vigilance of areas at risk. Preventive plans must go beyond simply identifying land at risk; they should include locating suitable land to cover the range of needs of a growing municipality (ADPC, 2003). The preventive approach is new to development planning and should be supported and watched over the coming years. Given the important differences in the level of land-use planning practices in each municipality, it is already clear that a case-by-case approach will be needed to assure that risk prevention is fully integrated into municipal development planning (UNDP, 2003).

The wrong timing - All NGOs expressed difficulties with approaching communities at the right time and with the right strategy. Building partnerships takes time, and attempts do not always have a positive outcome. For example, when the CoT tried to implement a capacity-building program in twelve informal settlements, two of them were simply not interested. Moreover, communities are more receptive to physical measures than to capacity building, which may seem too abstract (ADPC, 2003).

In some informal areas, communities have become accustomed to receiving external assistance, especially following disasters. Thus, they can be reluctant to undertake disaster risk management on their own (ADPC, 2003). The lack of collective memory in new informal settlements can also be an obstacle when trying to raise disaster risk awareness campaigns. When community members have actually never experienced a natural disaster, it becomes harder to rouse their interest in prevention, particularly in the face of other basic needs, such as water, electricity, waste removal (sanitation) and transportation (UNDP, 2002).

The wrong strategy - Daily problems of insecurity, unemployment, and insufficient social and physical infrastructure are much more threatening than a hypothetical flood or fire. Consequently, the history, particularities, and priorities of each community must be taken into account when trying to promote disaster risk management at this level, or the community may simply not be receptive to any effort. Further, UNDP (2002) has stressed that communities most vulnerable to natural events frequently have a disproportionately high number of illiterate

members. Tools and strategies for training and capacity building must therefore be adapted so that all can participate.

The wrong approach to the community - Lastly, it can sometimes be tempting, for the sake of time and efficiency, to implement participatory projects directly at the community level without the intermediate participation of a disaster management committee or forum. However, the sustainability of such an approach is questionable and most CDW's and NGO's recognize that. Although building the capacity of a local committee to manage its own risks alone is very difficult, sustainable development requires such efforts (UNDP, 2002). In any disaster risk reduction activity, the disaster management officials can no longer develop programmes in isolation or design one programme and duplicate it in several other communities.

The officials of the CoT can adopt this framework and use it to develop risk reduction programmes and strategies.

6.3. RISK REDUCTION STRATEGIES FOR LUSAKA INFORMAL SETTLEMENT COMMUNITY

This section addresses the problems identified in the progression of vulnerability through the safety model to assist in rooting out the problems and root causes. The solutions/control measures are suggested to reduce the disaster risk in Lusaka informal settlement. The implementation of this control measures will help the Lusaka community being put in safe conditions as well as building the resilience through community participation by involving them in the activities concerning their needs. The progression of safety model will be used to explain how to achieve safe conditions for the Lusaka informal settlement community.

6.3.1. Progression of safety model

The basis for the PAR idea is that a disaster is the intersection of two opposing forces: those processes generating vulnerability on one side, and the natural hazard event (or sometimes a slowly unfolding natural process) on the other. The image resembles a nutcracker, with increasing pressure on people arising from either side – from their vulnerability and from the impact (and severity) of the hazard for those people. The 'release' idea is incorporated to conceptualize the reduction of disaster: to relieve the pressure, vulnerability has to be reduced (Wisner *et al*, 2006).

The disaster pressure and release model (PAR) was first published in 1994 by Blaikie *et al* (1994) followed by Wisner *et al*, 2004. This model has now been accepted internationally for the explanation of the progression of safety (risk reduction) (Van Niekerk; D. & Van der Walt; G, 2005). According to Van Niekerk (2005) the pressure model indicates that there are three phases of which contribute to vulnerability, namely underlying causes, dynamic pressures and unsafe conditions. Linking the phases increases the risk in communities. The progression model of safety reverses the risk pressure with the aim of putting communities in safe conditions.

Despite some recognition of the human dimensions of disaster, there was a tendency until the early-1990s to view hazards as exclusively natural phenomena, and hence to take a predominantly scientific approach to disaster management. All these elements are dynamic in that they are subject to constant change and hence their outcome is unpredictable. According to the PAR model, the key to understanding the way people cope with hazards is the livelihood strategies that people choose (Twigg, 2004). This chapter illustrates the progression of safety with the aid of disaster pressure and release model. Progression of Safety model that is illustrated in Figure 27 in chapter 5 is based on the findings of the application of Progression of Vulnerability (figure 5), which is discussed in Chapter three (4), and this chapter will address the following aspects:

- Addressing root causes: Addressed in a developmental manner, the negative consequences caused by the legacy of the “Apartheid” regime. This to be achieved through the application of national governmental programs, which main focus areas should be poverty reduction and sustainable development.
- Achieving dynamic pressures: Focusing on developmental orientated programs on the provincial sphere, which supports the national initiatives.
- Achieve safe conditions: Local community orientated programs that would focus on the enhancement of a safer environment for all its inhabitants as well as the establishment of resilient and safe communities.
- Hazard reduction: The application of a range of measures that would lead to the reduction of hazards that could cause disasters.

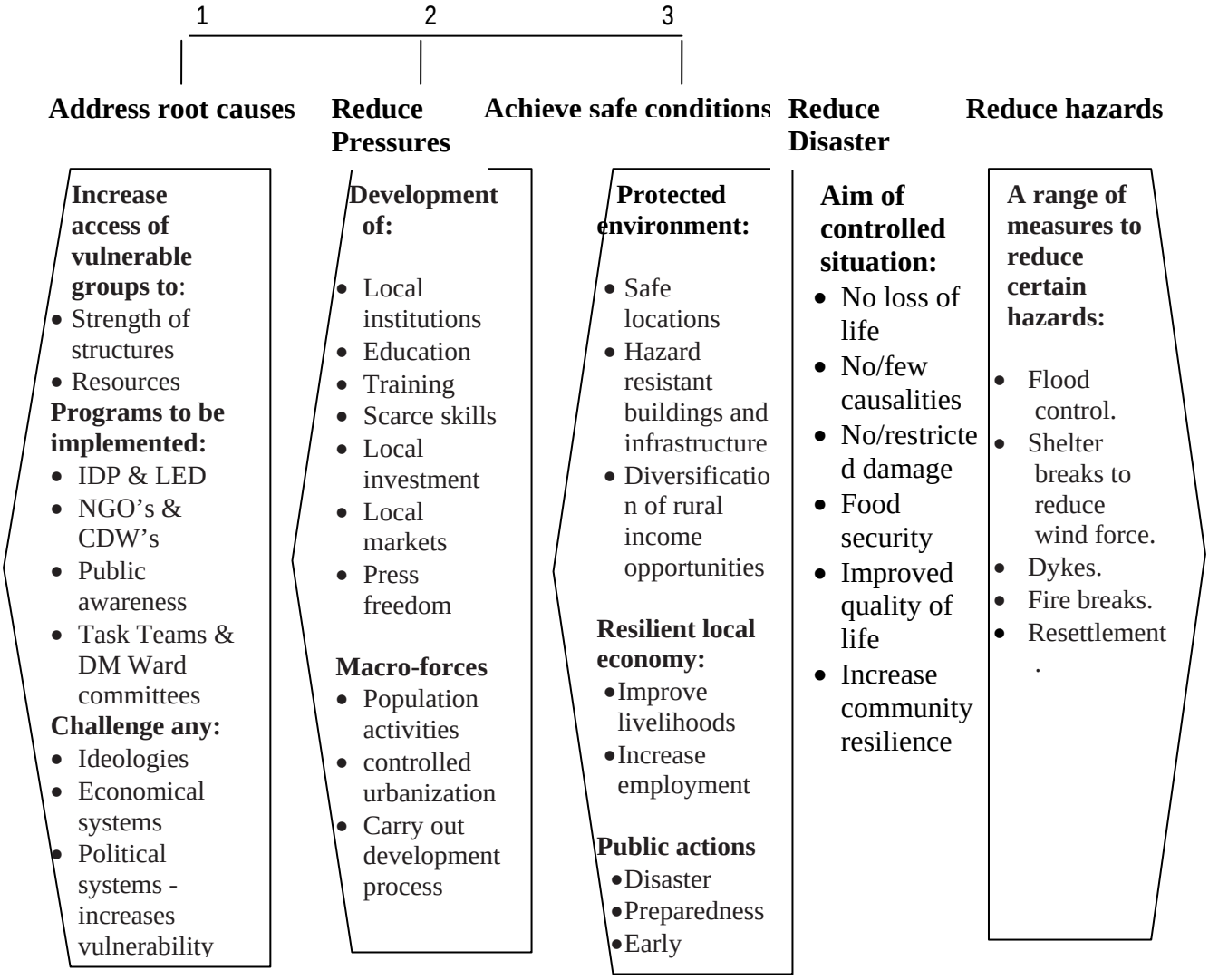


Figure 44*:* Progression of safety model

Source: Blaikie et al. 2004.

6.3.2. Addressing the root cause

The deep-rooted factors (poverty, unemployment, limited access to power, structures and resources) are now changed with the aid of pressure and release model. Poverty can be alleviated through application of government grants for qualifying members. Government should include Mamelodi-Lusaka informal settlement community in the implementation of risk reduction projects identified in Municipal and Provincial development and poverty reduction IDP's programme and development projects, as well as support existing community-LED (Local Economic Development) development initiatives and in that way poverty can be eradicated. Development policies must prioritize the growth of informal settlement areas, which have high percentages of unemployed communities and little public infrastructure, by engaging communities in creating necessary services and infrastructure. The CoT must enact laws that

foster the creation of community-driven projects. CoT must increase efforts to educate young people in urban communities on responsible sexual lifestyles and reproductive health practices as a public policy measure to effectively manage population growth. Unemployment can be solved by creating more jobs and transferring the job skills, experience and knowledge. Access to governance structures should be increased to Lusaka informal settlement community. Good governance is required to build active participation of the Lusaka informal settlement community (CoT, 2005).

This requires multi-sectoral participation and stakeholder consultations in order to both fully understand the range of hazards and vulnerabilities priorities as well as the potential solutions coming from NGOs, CBO'S, community-based enterprises, members of the community and the private sectors. Water & Sanitation Infrastructure need to be improved (TIEP, 2005).

Hygiene education awareness is also a critical component. Investments aimed at increasing awareness and changing of hygiene behaviours, such as regular hand washing or the regular emptying and maintenance of public latrines, greatly reduce urban morbidity and mortality rates from water and hygiene-related diseases. In informal settlements, these types of investments can achieve environmental health impacts that are more immediate, cost-effective, and equitably distributed than the adoption of water or sanitation infrastructure investments alone. Without the necessary water and sanitation infrastructure and hygiene education, the urban poor face high morbidity rates that will undermine their productivity and profoundly affect their ability to pull themselves out of poverty (TIEP, 2005).

6.3.3. Reducing the dynamic pressures

This process is addressed by providing essential basic services. There needs to be local institutions (schools, churches, clinics, etc) so that there can be institutionalization of flood prevention and mitigation in the area. Schools/training and education facilities play a vital role to ensure that communities are provided with relevant training and education to transfer skills, experience and knowledge of disaster risk management. Medical facilities such as clinic are needed to help the locals in administering medical assistance or emergency help. Installation of electricity can make life easier for this community since they rely on firewood collected from the veld which has a detrimental effect (soil erosion) to the environment. The community structures and committees need to be established in order for the community to be able to deal with the local hazards and disasters.

6.3.4. Achieving safe conditions

This is a practice that will protect the Lusaka informal settlement community and their property from being exposed to the risk of disaster. There is a variety of control measures that will enforce safe practices. Such measures include shelters built in a spaced pattern to reduce the risk of a hazard like fire. The use of fire-proof building material is a good preventative measure in reducing the negative effects of the hazard. There is a tremendous need to improve the physical infrastructure to reduce vulnerability to floods and also building of trenches to reduce the impact of floods.

6.3.5. Risk reduction measures for Lusaka informal settlement

Disaster risk reduction is the "systematic development and application of policies, strategies and practices to minimize vulnerabilities and disaster risks throughout society, to avoid (prevent) or limit (mitigate and be prepared for) the adverse impact of hazards, within the broad context of sustainable development" (Holloway, 2003. According to the Yokohoma Strategy and Plan for Action for a Safer World (1994), "Preventive measures are most effective when they involve participation at all levels from the local community through the regional level to the provincial and national government". According to Twigg (2001), preventive measures fail because the role-players involved in long-terms sustainable development programmes work in silos. The following are the recommended strategies for reducing the impact of disasters (Twigg, 2004):

- Raising structures above ground level using sand, wood or stilts.
- Using metal sheeting or stand bags to divert or hold back water.
- Digging channels to draw water away from dwellings.
- Building away from bodies of water or roads.

These measures show the importance of integrated or 'multi-sectoral' disaster risk management in informal settlements. For instance, although roads and stormwater departments may be primarily responsible for managing flood risks, environmental health workers/water and sanitation also play an essential role in flood risk management by providing accessible, dependable solid waste collection and disposal. The Disaster Management Training Programme (DMTP) 1992 and of 1994 lists nine (9) major components that can be involved in the CBDRM which provide a framework upon which a community framework for the CoT informal settlements can be developed; namely:

- Vulnerability Assessment – this activity provides the disaster manager with information regarding a particular community that is susceptible to the impacts of sudden or slow-onset hazards.
- Planning – there is a need to have plans in place that are agreed upon, that are implementable and for which commitment and resources are relatively assured.
- Institutional framework – this relates to the need for a decision-making structure, inter-departmental committees to co-ordinate plans, focus groups within each department that are responsible for the implementation of plans, as well as regional and community structures to implement strategies at a local level.
- Information systems – the preparedness plan must have an information network such as an early warning and monitoring system to facilitate disaster prediction, warning and evacuation communication to the community.
- Resource base – the requirements to meet an emergency situation will clearly depend upon the types of hazards the plan anticipates. Such requirements should be made explicit, and should cover all aspects of disaster relief and recovery implementation. Examples of resources are: shelter, medicines, food, communications' systems, relief workers, etc.
- Warning systems – by giving a vulnerable population adequate notice of an impending disaster, such people can either escape the event or take precautions to reduce the dangers.
- Response mechanisms – the staging of response is an essential factor in designing a preparedness plan. It is therefore important that in the warning process, various responses should be mobilized. This states that the National Disaster Management Centre (NDMC) must initiate the development of regulations for the implementation of a national standard response management system which should, *inter alia,* make provision for the development of partnerships between agencies involved in response and recovery and the private sector, NGOs, traditional leaders, technical experts, communities and volunteers for the purpose of enhancing capacity. The framework further adds that each stakeholder identified in the response management system must establish standard operating protocols or procedures (SOPs) for co-ordinating response and recovery operations and for ensuring government/business continuity. These SOPs must be consistent with the requirements of relevant legislation, regulations and standards.

- Public education and training – public education and training is critical to ensuring a change in behaviour and has to be afforded priority in all disaster management initiatives. Such education takes many forms, such as;
  - Public education in schools for children and young adults, emphasizing what actions should be taken in case of a disaster threat (for example, shack fires, floods, etc.);
  - Special training courses designed for community, either specifically or as an extra dimension of on going programmes such as First-Aid and Basic and Fire Fighting courses.
- Raising awareness and training - raising awareness and training are vital in disaster risk management for broad effect, quality and long-term strengthening of capabilities at municipal level. Central here are:
  - Raising awareness of hazards and vulnerabilities (above all through risk analyses);
  - Assessing costs and benefits of disaster risk management for individuals and communities;
  - Imparting know-how on specific disaster risk management measures, using the bottom-up approach.
- Rehearsals (drills) – rehearsals are also critical in achieving disaster preparedness both from a management and a community point of view. Not only will rehearsals/simulations emphasize points made in separate training programmes, but they will also test the system as a whole and invariably reveal gaps that otherwise might have been overlooked. This is critical, as disaster risks and the nature and magnitude of vulnerabilities which evolve, imply that disaster management strategies and Standard Operating Procedures (SOPs) need to be updated regularly.
- Societal measures – the mitigation of disasters will only come about when there is a consensus that this is desirable. Mitigation planning should therefore aim to develop a disaster "safety culture", one in which the general public is fully aware of potential hazards, chooses to protect itself as fully as possible and can readily support protective efforts made on its behalf.

In support of the above measures as outlined in the DMTP (1992), Victoria (2001) identifies the basic elements and features of Community-Based Disaster Risk Management as the following:

- People's participation – community members are the main actors and instigators; they also share directly in the benefits of disaster risk reduction and development.
- Priority should be given the most vulnerable groups, families, and people in the community. In the urban areas, the vulnerable sectors are generally the urban poor and informal sector, the elderly, the disabled, children and women.
- Risk reduction measures are community-specific and are identified after an analysis of the community's disaster risk (hazards, vulnerabilities, and capacities and perceptions of disaster risk).
- Existing capacities and coping mechanisms are recognized – CBDRM should build upon and strengthen existing capacities and coping strategies.
- Links disaster risk-reduction with development – this implies that CBDRM should aim to address vulnerable conditions and causes of vulnerabilities.
- Outsiders have a supporting and facilitating role – local people should invest in and own the CBDRM process, with outsiders providing minimal facilitating and expert support services.

The best way to instil in people the notion of prevention in dealing with natural disasters and influence their behaviour in the long term, however, is to involve them as far as possible in identifying disaster risk and its causes and then in planning and implementing pre-emptive measures.

6.4. DEPARTMENTS AND ORGANISATIONS' FUNCTIONS CONTACTS FOR THE IDENTIFIED HAZARDS DURING EMERGENCY

The following is the envisaged departments' functions required by the informal settlement's community during an emergency situation.

Table 11. Envisaged department's functions required during an emergency situation

Departments	Envisaged functions			Required resources		
	Preventative/mitigation measures	During incidents	Post incident (response)	During incident	Post incident	Preparedness /awareness
Disaster management centre	Monitor actions of other services. Public	Monitor. Coordinate all services during	Monitor Coordinate all services during	Dm staff	DM staff	DM staff

	awareness	major incidents.	major incidents.			
Housing	Limit land usage	Establish emergency housing	Manage emergency housing	Suitable facilities for emergency housing	Suitable facilities for emergency housing	N/A
Health & Social development	Materials on Public awareness	Determine health needs. Determine social needs.	Provide relief on health and social issues	Suitable facilities for emergency (health & social issues)	Debriefing of staff	Public awareness
Metro police	N/A	Access control. Warnings. Assist with rescue	Access control	Vehicles and loud hailers.	vehicles	N/A
Emergency Services (fire & rescue)	Public awareness	Rescue of trapped. Warnings. Search for missing.	N/A	Rescue equipments & vehicles. Data on missing.	Vehicles.	Public awareness. Leaflets.
EMS (Ambulance services)	N/A	Treatment of injured.	N/A	Medical equipments.	vehicles	Debriefing of staff
Transport	N/A	Transport for evacuation	N/A	Vehicles for evacuation.	N/A	N/A
Road & storm water	Public awareness	Lead agency. Determine needs.	Lead agency. Determine needs.	Suitable equipments	Suitable equipments	Materials on public awareness.
Water & Sanitation	Public awareness	Emergency repairs.	Restoration of services.	Suitable equipments	Suitable equipments	Materials on public awareness.
Electricity	Public awareness	Emergency repairs.	Restoration of services.	Suitable equipments	Suitable equipments	Materials on public awareness.
Environmental management	Public awareness	Determine environmental impact	Attend to affected environmen	Suitable materials and	Suitable materials and	Materials on public

			t	equipments	equipments	awareness.
NGO's & CDW's	Public awareness Volunteers	Provide assistance when required	Debriefing to staff & affected community	Provide suitable assistance	Provide suitable assistance	Community awareness

The above table and information regarding emergency response is included in this study because it allows the community during response/incidents to be able to know which role players and stakeholders they can contact and expect during emergency situation.

6.5. LEGISLATIVE FRAMEWORK FOR COMMUNITY-BASED DISASTER RISK MANAGEMENT

The South African Disaster Management Act, 57 of 2002 provides a legislative framework for achieving participatory risk assessment by providing direction for the implementation of disaster management in all spheres of government in South Africa, including the need for consultation with communities and stakeholders in order to reduce disaster risks by implementing disaster preparedness and mitigation measures, among others (Government gazette, 2005).

Given the fact that disaster management is a developmental issue and that development is a disaster management issue, the Local Government: Municipal Systems Act, 32 of 2000 in Section 26 (g) requires that "applicable disaster management plans" should be a core component of the Integrated Development Plans (IDP's) of municipalities in the country. These IDP's are to be developed by municipalities following a broader consultative process with all relevant stakeholders prior to their final adoption and publication (Municipal Systems Act, 32 of 2000). In line with the legislative frameworks as discussed above, the National Disaster Management Framework of South Africa (Government gazette, 2005) outlines steps that apply to the scope and development of disaster risk-reduction plans, projects and programmes to guide national, provincial and municipal spheres of government:

- Establish an informed multi-disciplinary team with the capacity to address the disaster risk and identify a primary entity to facilitate the initiative – this implies that disaster risk management requires both technical expertise in hazard processes, as well as an understanding of the complex social and economic conditions that drive disaster risk in vulnerable communities;

- Actively involve communities or groups at risk – disaster risk-reduction planning must always involve consultation between at-risk groups and/or communities and external service providers (Government gazette, 2005). This is based on the fact that risk-reduction measures are more effective when they are discussed and implemented collaboratively with those affected, as this allows for the inclusion of local knowledge and expertise;
- Address multiple vulnerabilities wherever possible – disaster risk-reduction projects and programmes must add value to other development initiatives. Within this context, multiple vulnerabilities can be addressed through the following outputs:
    - Improving socio-economic conditions and building community cohesion;
    - Ensuring the continuity of protective environmental services;
    - Increasing resilience and/or continuity of public services and infrastructure to better respond to external shocks.
- Plan for changing risk conditions and uncertainty, including the effects of weather;
- Apply precautionary principles to avoid inadvertently increasing disaster risk – this is based on the fact that the likelihood of inadvertent negative consequences are reduced if disaster risk-assessment actively informs the planning process, a competent multi-disciplinary team can be established, and mechanisms for transparent community consultation put in place.
- Establish clear goals and targets for disaster risk-reduction initiatives, and link monitoring and evaluation criteria to community based disaster risk-assessment findings. These must be linked to initial assessment findings to demonstrate the effectiveness of the specific initiative in reducing vulnerability or disaster loss.

Assessment findings must also be used to highlight learning points for future projects and programmes (ISDR, 2003). This provision draws its mandate from the provisions of the Disaster Management Act, 57 of 2002, which states that community participation and consultation are key elements which must be adhered to in the development of integrated development plans as these relate to the promotion by the public sector authorities of disaster-reduction measures at local level (Government gazette, 2005).

In line with the community-focused approach as discussed above, Bollin (2003) observes that the role of local or municipal authorities in disaster risk-management is being increasingly recognized and stressed in international discussions. The above guidelines are therefore key to

the implementation of community-based disaster risk management within the Lusaka informal settlement which forms the basis of the study. Key questions underlying this study as outlined in chapter one have been addressed, in line with the above principles, to ensure conformity with the South African legislative framework for achieving effective disaster management in line with sustainable development context (ISDR 2003). The above discussion demonstrates that disaster community participation is an integral element of the development agenda of the Republic of South Africa, and that this approach is reinforced by various international agreements (ISDR, 2005).

6.6. SUMMARY

In summary key elements of community-based hazard and vulnerability risk assessment for achieving risk reduction measures were explored with reference to community based disaster risk management as a theoretical framework (Chapter two). Community based disaster risk management was chosen as a relevant theoretical framework for the study because of the emphasis it places on community participation in matters relating to outside intervention aimed at the upliftment of local communities, and most importantly, to ensure local ownership and sustainability of disaster mitigation and preparedness measures.

To successfully eliminate and or reduce hazards there needs to be meaningful collaboration between different members/stakeholders of the community. Lusaka informal settlement community is exposed to a wide variety of hazards which need special attention in terms of employing preventive and mitigation measures. Deduced from the research survey, it is of vital importance that solutions be provided to minimize risks and vulnerabilities to the Lusaka informal settlement community through the use of this framework.

It is also of importance for the researcher to identify the social cleavages within a community in order to achieve risk reduction measures. The researcher point out that the community must take certain measures that will help make them less vulnerable to disasters, before and after they occur. The following are factors that were rooted-out from the application of vulnerability as part of the root cause and the dynamic pressures and found to be helpful in reducing the impact of disasters:

- Individual preparedness; families with strong internal coping systems and adequate access to external support are less vulnerable;
- Existing positive social norms, attitudes or values of reciprocity that persist even after disasters;
- Social interaction, as it can help influence how people perceive and respond to disasters leading to a culturally informed definition of the event within affected individuals;
- Trust; people usually seek confirmation of warnings from their neighbours, friends and relatives;
- Social cohesion and sense of community that help individuals in the community to cope with stress and offer physical and material assistance, and emotional sharing. Although most social bonds are enhanced or produced during and after disasters, the selflessness they portray help individuals cope with the aftermaths of disasters.
- Formation of community systems such as community organisations, church groups, social service providers and civic groups that have an open line of communication and a strong local social cohesion;
- Community member involvement and participation that involve older members of the community in the decision-making process and make them feel visible in the community;
- Communities need to identify and seek solutions to the problems that affect them, build self-reliance and take ownership of these problems.

Further more risk reduction strategies were analysed through the use of progression of safety model which gives solutions to the identified hazards and vulnerabilities of the community of Lusaka informal settlement.

CBDRM has the capability to provide CoT with a structured, cost effective system for the implementation of the requirements as set out in the Disaster Management Act of 2002. The variety of hazards and the complexity of relationships between hazards and communities' vulnerability make the community participation the logical tool to be used by disaster management in disaster risk reduction strategies. It is evident that the CBDRM involves undertaking precautionary and timely measures to minimize the effects of hazards and vulnerabilities on the community. They are therefore people-centred in nature as they require the full co-operation and effective participation of the "At Risk" communities in their planning

and implementation. Community-based hazard and vulnerability assessment is therefore important for developmental priorities of any municipality in order to realize their developmental agenda in line with the City of Tshwane Disaster Management Framework.

The researcher concludes the research thesis by suggesting recommendations for the CoT to implement the Community-Based Disaster Risk Management framework for the sake of the community and also assisting them to identify local hazards and vulnerabilities so that the CoT can review and update its Disaster Management Plan.

CHAPTER SEVEN:

CONCLUSIONS AND RECOMMENDATIONS

7.1. INTRODUCTION

The researcher concludes the thesis through achieving the objectives of the study and through the development of the community based hazard and vulnerability framework. Bringing community participation to disaster risk management is a difficult task, and all actors in the field recognize that it is very energy consuming. However, patience and listening are often rewarded with great achievements, to which all the examples described above can attest.

There is now a clear perception that disaster risk management cannot be treated in isolation and implemented solely in cooperation with disaster management agencies. Owing to the diverse factors contributing to disaster risk and the far-reaching impacts of a natural disaster, community-based disaster risk management can only have a sustainable impact as a multi-sectoral issue in CoT, comprising a broad range of sectors (e.g. Fire Brigade Services, Emergency Services (Ambulance), Disaster Management Services, Environmental management, Water & Sanitation, Road & Stormwater, Electricity, Housing, health and social development) at local and provincial levels.

7.2. CONCLUSIONS

In South Africa, there is a growing trend of increasing social and economic costs that include the under-development and lack of essential services, fragmented cities, population and economic growth, informal settlements, rapid and unplanned urbanisation, unpredictable climate change and environmental degradation. With the increasing level of natural disaster risks and a growing percentage of residents that occupy hazardous areas, these areas can become a breeding ground for diseases unless placement and development of communities are done through design and development planning with the aims of altering the effects of such events.

For the government to successfully reduce vulnerability of communities to disasters and meet the sustainable development, approaches to integrated development planning, spatial planning and community involvement in decision making need to be implemented. Development

planning is essential for reducing the negative conditions that are found in developing countries' urban areas. Structural poverty, standardised infrastructure and housing, high population densities, the concentration of economic assets and industrial activities can be reduced by either placing strict limits on development in hazardous areas, building regulations that ensures structures that can withstand disasters and land use practices and development that do not impact deforestation or wetlands negatively. Educating the community about these limits can contribute to the community being a disaster resilient community.

Risk reduction must become an important part of development programmes and risk reduction efforts should not only be induced by good governance and partnerships with multi-actor cooperation, but it should be integrated with poverty reduction, development policies, plans and programmes. Disaster risk reduction involves understanding and addressing the risks and vulnerabilities that people face and the preparedness of the community to disasters. The vulnerability to future disaster risks in disaster prone areas should be promoted in the following plans: Integrated Development Plan, the City Development Strategy and Spatial Development Framework.

Governments can prepare baseline assessments on disaster risks reduction; monitor and assess the physical, social, economic and environmental vulnerabilities as a means to adjusting early warning systems; incorporate catastrophes into economic projects; promote the integration of risk reduction into development planning strategies; and involve the local community in all aspects of disaster risk reduction with the objective of reducing disaster risks.

"The knowledge needed to establish a disaster resilience community is available, but a fabric of political will is needed to implement them" and planners and managers need to note that disaster resilience is an on-going process that requires multiple levels of analysis. CBDRM emerged as an alternative during the 1980s and 1990s. Over the past two decades it has become apparent that top-down approaches fail to address the needs of vulnerable communities, often ignoring local capacities and resources. The top-down approach can increase vulnerabilities and undermine the quality of life, security and resiliency. The CBDRM approach emphasizes the active involvement of communities in al phases of risk management. The ADPC approach to CBDRM concentrates on: 1. capacity building through training, 2. sharing experiences amongst practitioners and decision-makers, especially regional exchange and south-south learning, and 3. initiating linkages among national and local government

departments, NGOs and communities through local, national and regional platforms and associations.

The research revealed that although measures have been put in place to implement community-based disaster risk management, the level of community participation has not been mainstreamed within these measures. Only few strategies such as public education and training and awareness campaigns were implemented on a community participation scale of above thirty (30%) per cent. Implementation of the rest of the measures was rated below a scale of thirty per cent, with the result that no wholesale approach to implementing disaster management exists within Lusaka informal settlement.

The measures listed under in chapter five (5) needs to be implemented in a community-based disaster risk management approach to achieve effective disaster preparedness measures in Lusaka informal settlement. This approach could be replicated in other areas within and beyond the municipality in a quest to achieve effective community-based disaster preparedness and mitigation.

New methodologies had to be developed to deal with this situation and the CBDRM provides the logical solution to the community of Lusaka. The CBDRM provides the platform for widely diverse organizational and governmental agencies to participate in the full range of emergency management activities at all levels of government.

In the case of Tshwane, however, this solution is severely handicapped by a lack of information as is illustrated in this study. However Disaster Management Centre cannot ignore its duties due to a lack of suitable information for the community. While Disaster Management Centre is waiting for appropriate and correct data, daily life continues and people out there remain at risk or vulnerable to disasters. Community participation provides simple methods to perform hazard and vulnerability risk assessments that could be used in updating and reviewing the CoT disaster management plan as well as the Risk Atlas for Tshwane. Informal settlements in the City of Tshwane face many risks – crime, ill health, flooding, shack fires and environmental health risks. People in many informal settlements experience flooding, fires and environmental health risks as everyday, chronic risks. These risks can also rapidly upscale into local emergencies, leading to widespread loss of property, temporary displacement and prolonged hardship. For instance, severe floods events that have occurred annually in the South-Eastern

and North-Western regions of the CoT since 2000 have seen thousands of low-income residents evacuated from high-risk low-lying areas or sites adjacent to rivers and natural water-courses.

Similarly, in the case of shack fires, from 2000-2007, more than 5 000 informal shack fires incidents occurred in CoT alone, affecting 40 558 households. Most of these incidents resulted in houses being destroyed, along with household property and identity documents, seriously setting back the households affected. Each of these threats affects thousands of poor families every year within the CoT. They also create enormous demands on local authorities and humanitarian assistance organisations. Many settlements experience both severe fires and flooding (ponding) – sometimes even within the same season. This is because many of the same vulnerability factors increase exposure to these different risks, and lower local capability to manage them. For example, poor levels of environmental health increase the severity of both flooding and fires.

The whole process of addressing the hazards and risks vulnerabilities and their impacts on the community requires the active involvement and participation of the Lusaka informal settlement community whether through ward activities by the ward councillor, Community Development Workers (CDW's), Non-Governmental Organisations (NGO's) or any other system with all stakeholders partaking in the process. Based on the data collected and through consultation and participation with the residents/community members of Lusaka, the research concludes with the following needs that needs to be done to minimise risks and vulnerabilities in the informal settlement:

- The people of Lusaka should be allowed to drive the development process and their needs should be the cornerstone of any development initiative;
- Lusaka informal settlement community need to be educated and trained on issues such as LED and IDP programs in relation to disaster management plan;
- The municipality should strengthen its programs of teaching first aid and basic fire fighting to the community;
- Further geological studies in the area should involve community leaders. It is important to note that studies which are undertaken without the participation of the community will be dismissed by the community as unfounded.

For effective disaster identification and mitigation measures, the researcher has involved the community throughout the process and thus the end-results will produce a comprehensive and up-to-date risk profile database for the Lusaka settlement in ward 10 and will need effective Geographical Information System (GIS) applications for CoT to be able to capture and store data safely.

The challenge which have been set out in the Green Paper on Disaster Management namely "… how best to advocate for improved disaster management and risk reduction policies and practices so that these become integral aspects of existing strategies to achieve sustainable development and social equity" was met with the development of community-based hazard and vulnerability assessment framework for the community of Lusaka. This is an approach that relies on the knowledge, information and capacity of the community to remedy their disaster situation themselves and to help each other.

From the above discussion, the researcher concludes that community-based disaster risk management theory and its application are relevant for the study, as it emphasizes the conscious and participatory application of integrated measures in order to achieve identified objectives for the betterment of the lives of 'At Risk' communities.

This research has indicated that it is possible to mitigate the increased disaster risk and vulnerabilities caused by the identified hazards within Lusaka. This was made possible with the application of the "Progression of Safety Model" as adapted for this community-based hazard and vulnerability assessment framework. The developed framework should provide a more holistic and comprehensive approach to disaster risk management within the City of Tshwane. This framework can also be utilised as the base design for other informal settlement within the City of Tshwane.

7.3. RECOMMENDATIONS

It is recommended that the research be approved by the CoT disaster management centre as part of the implementation of the community-based disaster risk management and also the proposed strategies be implemented or form part of the risk reduction project. It is also recommended that the implementation of this framework be approved. The CoT's first activity

in a community should be forming a local task team, representative of the community and other relevant stakeholders in order to ensure the implementation of the framework. This committee should be elected during a project launch workshop, which convenes community leaders (ward councillors), local organisations, local business sectors, the public at large and municipal and government sector departments. A capacity-building activity will starts immediately after the formation of the committee and will include a discussion on the meaning and implications of the community and disaster risk management.

In all the extensions/sections of ward 10 (Lusaka informal settlement) included in the research, a task team will involve various stakeholders (Parks, Housing department, Health and Social development, Water and Sanitation, Electricity, Road Storm and Water, Environmental Management, Metro Police, Fire Brigade Services, Disaster Management Centre, and Provincial and Local Government (Gauteng), etc. The researcher believes that a joint effort will be able to clean the Haartebeeststream that runs through Lusaka informal settlement, at the same time reducing the problem of health concern and the level of floods. While this community risk identification task will also creates a context for a wider discussion involving emergency reactions, absence of shelters, potential interruption of communication, and lack of information on emergency procedures on this community.

This discussion will also set the tone for a second series of workshops on disaster risk reduction strategies. The outcomes and recommendations from the research are an interesting pool of experience based on a common conceptual goals and strategy, comprising the following elements:

- Identification of the major actors and organization of local disaster risk management;
- Participatory planning of disaster risk management measures;
- Raising awareness and training;
- Integration and intervention of the provincial and national disaster risk management;
- Implementing and monitoring the planned measures; and
- Process monitoring and evaluation.

Long-term participation cannot be ensured through applying and imparting CBDRA instruments in a standardized way. If measures are also taken to have the approach adopted by local and

national organizations and institutions, the participation can establish itself as part of social life beyond the specific planning process. To be able to verify whether these requirements should be met in the community, the following indicators should be developed:

1. Existence of a stable community disaster risk management committee/task team:
    - The group should meet regularly and draws up minutes on the results of the meeting.
    - The team should be comprised of volunteers, respected figures in the community, local organisations and representatives of different sectors from the municipality.
    - A permanent room should be made available to the team for meetings (assembly room with communication facilities and somewhere to store documents, etc.).
    - The team should have a basic knowledge of disaster risk management and a common understanding of the need for it and what it can do.
    - At least one representative of the municipal authority with decision-making powers should take part in the team/committee.
    - The tasks and responsibilities of the group, of subgroups and members should be clearly defined.

2. The team/committee should be well informed about the background and responsibilities of disaster risk management centre:
    - A hazard map should be made available, which the group members know about and have access to.
    - An emergency plan should be developed (incl. inventory of personnel and physical resources, emergency committees, evacuation plan, provisions for emergency shelter).
    - The group should be provided with basic documents on the strategy and measures of disaster risk management for the CoT.
    - Lusaka informal settlement vulnerabilities have been ascertained and documented and areas at risk identified.
    - An operative proposal for community-based disaster risk management measures should be drawn up and finalized.
    - According to the discussion with the DMC, the CoT will take account of this proposal in its plan of operations.

3. The awareness of the community at risk is being raised and will be involved in the:
    - Activities to raise the awareness of the community of Lusaka informal settlement, in ward 10 will be carried out – regularly and continuous as far as possible.
    - The community-based disaster risk management committee/team will be supported by the community in analyzing risks and drafting programs and measures of action.

- There are clear indications of the participation of the community in disaster risk management activities (e.g. further training in emergency courses, disaster preparedness exercises, evacuations/simulations).

4. Support the strengthening of local communities' response capability through:
   - Assessment and improvement of community preparedness measures in fire and flood prone informal and formal areas on lessons learned from ongoing pilot study;
   - Development of community tools and methods for effective disaster risk reduction;
   - Targeted-action at flood high risk community areas and develop plans to strengthen their capacity and build their resilience (e.g. Lusaka informal settlement);
5. Mobilization of a cadre of local disaster management ward committees/volunteers through disaster management officials responsible for training communities in disaster preparedness and establishing an effective chain of communication.

Risk reduction is not a stand-alone sectoral theme but needs to be consciously integrated into the City of Tshwane development planning. It is both tragic and futile to see the benefit of years or decades of development investment washed away in a fire or flood, when marginal additional investment in incorporating hazard resistance could have protected these assets. Recognition of the proneness to natural hazards of each geographical location and the use of available hazard maps to assess risks needs to become an integral part of each project appraisal by development agencies. Thus disaster risk assessment should be part of the project appraisal process just as environmental impact assessment is; and construction adhering to higher hazard resistance standards becomes mandatory for hazard-prone locations.

The lack of suitable community structures and forums made it impossible to perform accurate disaster risk and vulnerability assessments for Tshwane. This is worrying as the lack of disaster management centre does not reflect on the ability of CBDRM as a disaster management tool to perform, but rather stresses the fact that pro-active disaster management in Tshwane is still in an infant stage. As there is currently no scientific method of quantifying disaster risk and vulnerability levels in the City of Tshwane, it is recommended that funds should be allocated to the designing and development of a fully functioning community structures and forums that, in future, could facilitate proper decision making on disaster management in terms of prevention, mitigation, preparedness and response before and during the incidents.

ANNEXTURE A:

RESEARCH QUESTIONNAIRES

COMMUNITY BASED HAZARD AND VULNERABILITY RISK ASSESSMENT: A CASE STUDY IN LUSAKA INFORMAL SETTLEMENT, CITY OF TSHWANE

INTERVIEW QUESTIONNAIRE

To whom it may concern

Dear Sir/Madam

I, Thabang Thinda, am currently registered as a Masters Degree student at the Disaster Risk Management Training and Education Centre for Africa (DiMTEC) at the University of the Free State (Student number: 1997 544 661). As part of the process of completing my dissertation in partial fulfilment of the requirements of Masters Degree in Disaster Risk Management, I am conducting research which involves interviews and focus group discussion with the community/participants.

My dissertation topic is entitled "A Community-based Hazard and Vulnerability Risk Assessment study in Lusaka informal settlement"; ward 10 in the Eastern region with the City of Tshwane. The main aim of the study is to engage in an exploratory and descriptive of the application of community-based approaches in identifying hazards and vulnerabilities within the Lusaka informal settlement in order to develop strategies that could be employed for disaster mitigation and preparedness within the area.

The questionnaire is completed anonymously and should take approximately 20 minutes of your time.

You have been selected to participate in the study based on the fact that you were a resident of the Lusaka informal settlement for a minimum period of three (3) years and that you are above twenty five (25) years of age, with the ability to read and understand English. This will assist the

community in knowing their vulnerabilities and the hazards around them better and will also help identify and prioritize the projects in conjunction with the City of Tshwane Disaster Management Centre and Integrated Development program.

I therefore invite and encourage you to contribute to this study by responding to the questions posed hereafter. Your answers and views are important and will be taken into consideration.

Thank you for your cooperation.

_____

Thabang Thinda

IMPORTANT NOTE

Before commencing an interview it is important to convey the following information to the respondent: This questionnaire is completed anonymously.

1. Participation is voluntary.
2. If there is any question which the respondent feels strong about not to answer, then he/she is not compelled to do so.
3. Information gathered is purely for research purposes.

During this survey, the idea is to augment the information required for obtaining an overview of the community by speaking with people who fill in the gaps where information cannot be acquired through other techniques. Working with communities in a process where they determine their needs as well as implement appropriate solutions will lead to sustainable actions that reduce vulnerability and promote a better quality of life as well as enhancing resilient communities.

HOUSEHOLD SURVEY: QUESTIONNAIRES

PART A: PERSONAL PROFILE:

Please answer each question and reflect your true reaction when doing so.

Indicate your choice by marking the appropriate block with an "X".

1. Gender

Male	
Female	

2. The head of this household is a…

(1) Child (including orphans)	
(2) Older person (above 60 years of age)	
(3) Single mother	
(4) Single father	

(5) Father and Mother (married/partners)	
(6) Person with disability/chronic illness	

3. Household members (including members that may not permanently be living there)

Male	Number					
0-16	1	2	3	4	>4 specify	
17-25	1	2	3	4	> 4 specify	
26-48	1	2	3	4	>4 specify	
49-59	1	2	3	4	>4 specify	
60-	1	2	3	4	>4 specify	
Female	Number					
0-16	1	2	3	4	> 4 specify	
17-25	1	2	3	4	>4 specify	
26-48	1	2	3	4	> 4 specify	
49-59	1	2	3	4	>4 specify	
60-	1	2	3	4	>4 specify	

4. In which type of household do you reside in?

Brick house /RDP	
Shack build of corrugated iron	
Shack build of cardboard	
Shack build of plastic	

5. In which extension of Lusaka informal settlement do you live?

Sections	Extension 22	Extension 18	Extension 12	Extension 11
BB				
BO				
RR				
Serobe				
Snake park				
Craca				
Mehlareng				
Sizwe				

6. How long have you been staying there?

One to two years	
Two to three years	
three to four years	
Five and above	

PART B: EDUCATIONAL BACKGROUND

7. What is the highest level of education in your household?

Level of education	No. of Household members	Male	Female
(1) None			
(2) Primary school			
(4) Secondary school (excluding Grade 12)			
(5) Grade 12			
(6) A tertiary qualification			

8. How many children of school going age (6-20 years old) in this household do not go to school? (Only answer this question if this household has children of school going age)

Girls 6-13 (primary school)	Boys 6-13 (primary school)	Girls 14-20 (secondary school)	Boys 14-20 (secondary school)

PART C: CAPACITY ASSESSEMENT

9. Which of the following services is available in your dwelling?

Bucket toilets	
Flush toilets	
Running water /river	
Electricity	
Sanitation services	
Community stand pipe	
Water supply	
Health facilities	
Education	

10. How reliable or efficient is the refuse collection in your area?

	Weekly	Monthly	Other (specify)
Very reliable			
Reliable			
Not reliable			

11. List of basic needs is set out below. How important do you regard each and indicate whether it is available or not.

Basic needs	Available	Not available	Very important	Important	Not important
Sanitation					
Refuse removal					
Sewage system					
Street cleaning					
Water					
Street lights					
Transport					
Tarred road					

PART D: COMMUNITY BASED DISASTER RISK MANAGEMENT QUESTIONS

12. Do you regard your knowledge of disasters as?

Good	
Average	
Poor	

13. Do you regard your knowledge of hazards as?

Good	
Average	
Very poor	

14. Do you regard your knowledge of vulnerability as?

Good	
Average	
Very poor	

15. Hazards identification

Please indicate on the table below the hazards that are applicable to Lusaka informal settlement.

HAZARD	LOCATION (SPECIFIC)	PROBABILITY	FREQUENCY	INTENSITY
Floods				
Shack fires				
Pollution (waste)				
Veld fires				
Severe weather				
Other, specify				

Choose between low medium high
HIGH---EXTREMELY DANGEROUS
Medium-----dangerous
Low------average

16. Vulnerability assessment

(What aspects of vulnerable elements increase the disaster risk of this hazard?)

COMMUNITY:	Vulnerable elements exacerbating the possible impact of the hazard			
HAZARD	SOCIAL	PHYSICAL	ECONOMIC	ENVIRONMENTAL

17. Are there, as far as you are aware, any locally formulated strategies for the management of the following hazards in your area? *(Indicate your choice by marking the appropriate block with an "X".*

HAZARDS	"YES"	"NO"
Threat of shack and veld fires		
Threat of flooding		
Threat of epidemics/diseases		
Threat of pollution (wastes)		
Severe weather (thunderstorm)		
Other, specify		

18. Has the community, as far as you know, ever been involved in the planning of the following disaster management measures?

DISASTER MANAGEMENT MEASURES	YES	NO
Vulnerability Assessment		
Response Mechanisms		
Public Education and Training		
Institutional Arrangements/frameworks		
Spatial Planning Measures		
Conflict Reduction Measures over limited water resources		

18.1. Where your answer is "Yes" to ABOVE question, do you find these strategies?

EFFECTIVE NOT EFFECTIVE UNCERTAIN

a. Please motivate your answer.

_____

_____

_____

19. Do you think indigenous knowledge systems were incorporated sufficiently in the management of hazards listed in ten (15) above? YES NO

19.1. Please motivate your answer.

COMMENTS

_____
_____
_____
_____

Thank you for taking your time and putting your efforts to complete this interview questionnaire
THE END!!

BIBLIOGRAPHY

Abarquez, Imelda and Murshed Zubair 2004 Community-Based Disaster Risk Management: Field Practitioners' Handbook. ADPC, UNESCAP and DIPECHO Bangkok.

Abarquez, I. and Mushed, Z. Community-based disaster risk management: A field practitioners' handbook, Hong Kong: Asian Disaster Preparedness Centre, 2004. www.adpc.net/pdr-sea/publications/12Handbk.pdf.

Abudho, R.A. and C.C. Mhlanga. 1988: Slum and squatter settlements in Sub-Saharan Africa: Towards a Planning Strategy. USA: Library of Congress

Allen, F.R., 1992: The Management of Risk to Society from Potential Accidents. Elsevier Applied Science.

Anderson, M.B., and Woodrow, P., 1990. Disaster and Development Workshops: A Manual for Training in Capacities and Vulnerability Analysis. Harvard: Harvard University: International Relief/ Development Project.

Anderson, M.B. and Woodrow, P.J. 1989. Rising from the Ashes: Development Strategies in Times of Disaster, Boulder, Colo,: Westview.

Annon (2006), Developing Community-Based Disaster Risk Reduction in NAD and West Sumatra

Asian Disaster Preparedness Centre (ADPC) 2004. Buildig Disaster Risk Reduction in Asia: A Way forward ADPC Looks Ahead to 2015. ADPC, Bangkok, Thailand

Asian Disaster Preparedness Centre (ADPC) (2004). Community-based disaster risk management. Field work Practioner's Handbook. Asian Disaster Preparedness Center, Klong Luand, Thailand.

Asian Disaster Preparedness Centre (ADPC) 2003 Third Disaster Management Practitioners' Workshop for South East Asia, Proceedings of the workshop on institutionalizing CBDRM in government policy-making, planning and program implementation, 10-13 May 2003, Bangkok.

Asian Disaster Preparedness Program (ACDP), 2004. Building Disaster Risk Reduction in Asia: A way forward ADPC looks ahead to 2015. ADPC, Bangkok. Thailand.

Asian Disaster Preparedness Centre and Duryog Nivaran (South Asia Network). 2002. Tenth international course on community-based disaster management. Bangkok: Thailand.

Asian Disaster Preparedness Centre, Community-Based Disaster Management, Course handouts, July 8-19, 2002, Bangkok, Thailand.

Asian Disaster Preparedness Centre (ADPC). 2000, Building safer communities: Disasters Risk Management Initiatives, CBDM – four course handouts,

Blaikie, P., Cannon, T., Davis, I., and Wisner, B., 1994. At Risk: Natural Hazards, People's Vulnerability and Disasters. Routledge: London.

Bollin, C. 2003. Community-based disaster risk management. [Online] http://www.gtz.de. Accessed: 18 May 2008.

Burkey, S. 1996. People First. A guide to self-reliant participatory rural development. London: ZED Books.

Bekker, S. & Swart, K. 2002. The relationship between migration and the HIV/AIDS pandemic: a preliminary South African analysis. Cape Town: Provincial Government Western Cape.

Bekker, S. 2002. Migration study in the Western Cape. Cape Town: Provincial Government Western Cape.

Booysen, H.J., 2001: Ontwikkeling van hulpmiddels vir die bestuur en beplanning van 'n stedelike vloedvlakte : 'n gis toepassing. Universiteit van die Vrystaat.

Cannon T. (2004), "At Risk: Natural Hazards, People's Vulnerability and Disasters". Proceedings of the CENAT Conference, Switzerland 28 November - 3 December, 2004

Coburn AW, Spence RJS, Pomonis A 1994, Disaster Mitigation. New York/Geneva:
United Nations Development Programme/Department for Humanitarian Affairs, UN Disaster Management Training Programme module.
http://undmtp.org/english/Disaster_mitigation/disaster_mitigation.pdf

City of Tshwane Metropolitan Municipality. 2008. Disaster Management Plan, level 1. Pretoria: City of Tshwane Metropolitan Municipality. New version.

City of Tshwane Metropolitan Municipality. 2007. Macro-Risk Assessment. Pretoria: City of Tshwane Metropolitan Municipality. Unpublished report.

City of Tshwane Metropolitan Municipality. 2006. A transect walk undertaken in Itireleng informal settlement to observe community vulnerability. Pretoria: City of Tshwane Metropolitan Municipality.

City of Tshwane Metropolitan Municipality. May 2005. Tshwane Integrated Development Plan. Revision cycles no 3. Pretoria: City of Tshwane Metropolitan Municipality. Unpublished report.

City of Tshwane Integrated Environmental Policy (TIEP) January 2005. Housing, City Planning and Environmental Management Department. City of Tshwane metropolitan municipality: Pretoria

City of Tshwane Disaster Management Master Plan. February 2004. Final Draft: City of Tshwane Metropolitan Disaster Management Centre. Pretoria.

City of Tshwane Metropolitan Municipality. 2003. Designing a master plan for disaster management: vulnerability analysis. Pretoria: City of Tshwane Metropolitan Municipality. Unpublished report.

Coburn, A.W. Spence, R.J.S. & Pomonis, A. 1991. United Nations Disaster Management Training Program: Disaster Mitigation. First edition, UK, Cambridge: Architectural Research Ltd.

Coch, N.K., 1992: Geo-hazards, Natural and Human. Prentice Hall.

Davis, I. & Hall, N. (1999), the Perception of Risk at Local Levels and Ways to Measure Community Vulnerability, Benfield Hazard Research Centre.

de Vos, A.S., Strydom, H., Fouché & Delport, C.S.L. 2005. Research at grass roots: for the social sciences and human service professions. 3rd Edition. Pretoria: Van Schaik Academic.

de Dios HB (2002) Participatory Capacities and Vulnerabilities Assessment: Finding the link between disasters and development. Quezon City: Oxfam Great Britain – Philippines Programme.
http://www.proventionconsortium.org/themes/default/pdfs/CRA/PCVA_2002_meth.pdf
Department of Local Government: Gauteng Province, 2005. Disaster Management Plan. Gauteng Provincial Government: Johannesburg. Unpublished report.

Disaster Management Training Programme. 1994. Disaster preparedness. United Nations Development Programme. University of Wisconsin Disaster Management Centre. Jose Luis Zeballos. PAHO. [Online] www.undmtp.org. Accessed: 19 August 2008.

Disaster Management Training Programme (DMTP). 1992. An overview of disaster management: 2nd Edition. United Nations Disaster Management Programme: University of Wisconsin Disaster Management Centre.

Dobberts, ML. 1982. Ethnographic research: Theory and applications for modern schools and societies. Praeger. New York. NY. USA.

Faling, W. 2008. Vulnerability to disaster impacts: one of the most underestimated issues in urban development? A paper presented at the Planning Africa Conference, Johannesburg, South Africa.

Federal Emergency Management Agency (FEMA). Multi-hazard identification and risk assessment: A cornerstone of the national mitigation strategy. Washington, DC: FEMA, 1997.

Guardian. 2005. Disasters and how to avert them. www.guardian.co.uk/life/feauture/story/0,,1532312,00.html. Accessed 27 October 2008.

Hall, Nick, (1999). Coordinator. Improved Vulnerability and Capacity Analysis for Community Based Disaster Mitigation. ECHO/EU funded research project (1989-1999) London: South Bank University.

Hardboy, J.E. and D. Satterthwaiter. 1989: Squatter settlements: life in the urban Third World. London: Earth Scan.

Heijmans, A. & Victoria, L. P. 2002. Citizenry-based & development – orientated disaster response: experiences and practices in disaster management of the citizen's disaster response network in the Philippines. Quezon City: Centre for Disaster Preparedness.

Heijmans, A. 2001. 'Vulnerability": A matter of perception. London: Benfield Greig Hazard Research centre.

Huchzermeyer, M. 2001. From "contravention of laws" to "lack of rights": redefining the problem of informal settlements in South Africa http://www.brookes.ac.uk/schools/planning/dates/naerus/workshop2001/papers/huchzermeyer.rtf

IDNDR (International Decade for Natural Disaster Reduction) 1999. Proceedings: programme forum. Geneva: IDNDR.

IDNDR (International Decade for Natural Disaster Reduction) 1999. Proceedings: programme forum. Geneva: IDNDR.

International Federation of Red Cross and Red Crescent Societies (IFRC), 2003. "World Disasters Report 2003", Focus on Reducing Risk, Geneva, 2003.

ISDR. 2005. Hyogo framework for action: building the resilience of nations and communities to disasters. Kobe, Hyogo, Japan [online]. Accessed: 21 November 2008.

ISDR. 2002. Living with risk: a global review of disaster reduction initiatives. Geneva: Switzerland.

ISDR, Mobilizing Local Communities in Reducing Disasters, Geneva, 2000.

Itano, N. 2001: South Africa's revitalisation to start in Alexandra. http://www.csmweb.emweb.com/durable/2001/04/24/p7s2.htm

Kienberger S, and Steinbruch F (2005) PGIS and disaster risk management: Assessing vulnerability with PGIS methods – Experiences from Búzi, Mozambique. Mapping for Change, Int. Conference on Participatory Spatial Information Management and Communication, PGIS '05, 7.09. – 10.09.2005, Nairobi, Kenya

Kotze, A. Von and A. Holloway, 1996, Reduction Risk: Participatory Learning Activities for Disaster Mitigation in South Africa, IFRCRCS & Department of Adult & Community Education, University of Natal.

La Trobe, S. 2005. Mainstreaming disaster risk reduction: a tool for development organizations. London: Benfield Greig Hazard Research Centre. Working paper.

Leedy, P.D. and Ormrod, J.E. 2001. Practical Research Planning and Design, 7th Edition. New Jersey: Prentice-Hall Inc.

Mason, B. 2006. Community disaster resilience: A Summary of the March 20, 2006 Workshop of the disasters roundtable. Washington D.C.; Academies Press.

Mail & Guardian, 2005. Spate of bombings hits Swaziland. (Online). Retrieved from: http://www.mg.co.za/articlespage.aspx?area=breaking-news-africa/&articleid=2551242 (2005, April 12).

Maskrey. A. 1989. Disaster mitigation: A community-based approach. Development guidelines3.

McEntire. D. A., Fuller, C. W. & Weber, R. 2002. A comparison of disaster paradigms: the research for a holistic policy guide. Public Administration Review, vol. 62, no. 3, p. 267-281.

Meinzen-Dick, R, Adato, M, Haddad, L and Hazell, P. 2003. Impacts of agricultural research on poverty: Findings of an integrated economic and social analysis. EPTD 34 Discussion Paper No. 111 and FCND Discussion Paper No. 164. IFPRI. Washington DC. USA. : Oxfam.

Midgley, J. Hall, A., Hardiman, M & Narine, D. 1986. Community participation, social development and the state. Londao: Methuen.

Miller, G.T., 1999: Living in the Environment; Principles, Connections and Solutions, Eleventh Edition. Brookes/Cole Publishing.

Miller, G.T. 1992: Living in the Environment. Wadsworth: Carlofonia.

Miller, J.B., 1997: Floods: people at risk, strategies for prevention. United Nations, New York.

Oxfam Briefing Paper. 2007. From weather alert to climate alarm. Disasters increase as climate change bites. Oxfam International.

Pearce, L. An integrated approach for community Hazard, Impact, Risk and Vulnerability Analysis: HIRV. Unpublished doctoral thesis. Vancouver: UBC, 2000.

Reid. 2000. Community participation: How people power brings sustainable benefits to communities. Office of Community Development: USDA Rural Development, Washington D.

Sanderson, D. 2000. Cities, disasters and livelihoods. Risk Management, vol. 2, no. 3, p. 49-58.

Scrimshaw, S. 1990. Combining quantitative and qualitative methods in the study of intra-household resource allocation. In: Rogers, B and Schlossman, L (Eds). Intrahousehold resource allocation issues and methods for development policy and planning. United Nations University Press. Tokyo. pp 86-88.

Shaw R.and Okazaki K. (2004) Sustainable Community Based Disaster Management Practices in Asia: A User's Guide, UNCRD

Stats SA. 2003. Census in brief: 2001. Government of the Republic of South Africa. Government Printers. Pretoria. South Africa.

SOUTH AFRICA. 2002. Disaster Management Act (Act 57 of 2002) Pretoria: Government Printer.

SOUTH AFRICA. 2000. Local Government Municipal Systems Act (Act 32 of 2000) Pretoria: Government Printer.

SOUTH AFRICA. 2000b. Local Government Municipal Systems, Act 32 of 2002. Pretoria: Government Printer.

SOUTH AFRICA. 1999. White Paper on Disaster Management. Pretoria. Ministry for Provincial Affairs and Constitutional Development. Pretoria: Government Printer.

SOUTH AFRICA (Republic). 1998. The White Paper on Local Government. Ministry for Provincial Affairs and Constitutional Development. Pretoria: Government Printer.

SOUTH AFRICA. 1996. Constitution of the Republic of South Africa (Act 108 of 1996) Pretoria: Government Printer.

Skidmore, A., 2002: Environmental Modeling with GIS and Remote Sensing. Taylor and Francis, London.

Twigg, J. 2007. Characteristics of a disaster-resilient community: A Guidance Note. London: Disaster risk Reduction Interagency Coordination Group.

Twigg, J. (2005), Community Participation – Time for a Reality Check? in UN/ISDR "Know Risk", Geneva, 2005.

Twigg, J. (2004), Disaster Risk Reduction: Mitigation and Preparedness in Development and Emergency Programming, Good Practice Review - Humanitarian Practice Network (HPN), London.

Twigg, J. 2001. Sustainable livelihoods and vulnerability to disasters. London: Benfield Greig Hazard Research Centre. Working paper.

Twigg, John. (ed.) 1998, Living with Disaster. Intermediate Technology Publications: London.

Twigg J. 1998. The Human Factor in early warning: Risk Perception and Appropriate Communications. Proceedings of Potsdam, Early Warning Conference (Forthcoming)

Twigg, John. and Bhatt, Mihir, R., 1998. Understanding Vulnerability. South Asian Perspectives, London: Intermediate Technology Publications.

United Nations International Strategy for Disaster Reduction (ISDR), Building Disaster Resilient Communities: Good Practices and Lessons Learned, 2007. www.unisdr.org/ngos-good-practices

United Nations Centre for Regional Development (UNCRD). 2007. Community based disaster management: empowering communities to cope with disaster risks. Kobe Japan, March 2007. [Online] http://unpan1.un.org. Accessed: 15 April 2007.

United Nations International Strategy for Disaster Reduction (ISDR), Building Disaster Resilient Communities: Good Practices and Lessons Learned, 2007. www.unisdr.org/ngos-good-practices

United Nations International Strategy for Disaster Reduction (ISDR), living with Risk: A global review of disaster risk initiatives, New York and Geneva, 2004. http://www.unisdr.org/eng/about_isdr/bd-lwr-2004-eng.htm.

United Nations (UN). 2002. Key outcomes of the summit. Johannesburg Summit 2002: World Summit on Sustainable Development. Johannesburg, South Africa, 26 August - 04 September 2002. [Online]. www.johannesburgsummit.org. Accessed: 19 October 2008.

United Nations. 2002. Living with Risk: A global review of disaster reduction initiatives. Geneva: International Strategy for Disaster Reduction (ISDR).

United National Disaster Management Training Programme (UNDMTP), 1992. Overview of disaster management. 2nd Edition. [Online]
http://www.undmtp.org/english/Overview/Overview.pdf. Accessed: 18 October 2008

United Nations Development Programme. 1991. Disasters and Development: Disaster Management Training Programme. Geneva Switzerland

Van den Berg, J. and Manley, C., 2002: Madibeng; Assessment of available resource data and information for use in risk management. Enviro Vision CC.

Victoria, L. s.a. 2000. Community-based approaches to disaster mitigation. Centre for Disaster Preparedness, paper for AUDMP Regional Workshop, University of Alabama: Birmingham.

Villagrán JCV (2006) Vulnerability: a conceptual and methodological review. UN University - Institute for Environment and Human Security, 4/2006, 64pp.

Von Kotze, Astrid. And Holloway, Ailsa. 1996. Reducing Risk Participatory learning exercises for disaster mitigation in Southern Africa. International Federation of Red Cross and Red Crescent Societies, Geneva.

WCDR, The Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters", www.unisdr.org.

Weathering the storm, 2008. Participatory risk assessment for informal settlement. Disaster Mitigation for Sustainable Livelihoods Programme

WHITE, P., PELLING, M., SEN, K., SEDDON, D., RUSSELL, S., and FEW, R. (2005): Disaster Risk Reduction. A development Concern. DFID.

Wisner, B. Blaikie, P. Cannon & Davis I. 2006. At Risk: Second Edition. London: Routledge.

Wisner, B. (2006), Let Our Children Teach Us! A Review of the Role of Education and Knowledge in Disaster Risk Reduction, ISDR Inter-Agency Task Force Cluster Group on Education and Knowledge.

Wisner, B., Blaikie, P., Cannon, T. & Davis, I. &. 2004. At risk: Natural hazards, people's vulnerability and disasters. 2nd edition. Routledge. London and New York.

Wisner, B. (2006), Let Our Children Teach Us! A review of the role of Education and Knowledge in Disaster Risk Reduction, ISDR Inter-Agency Task Force Cluster Group on Education and knowledge. www.proventionconsortium.org

Wittenberg, J and Sterman, JD. 1996. Self-organisation, competition and succession in the dynamics of scientific revolution. Massachusetts Institute of Technology (MIT). Cambridge. MA. USA.

World Bank, 2000: Attacking Poverty. Oxford University Press.

World Summit on Sustainable Development. Johannesburg, South Africa, 26 August - 04 September 2002. [Online]. www.johannesburgsummit.org. Accessed: 19 May 2007.

Zschau, J. and, Küppers, A.N., 2003: Early Warning Systems for Natural Disaster Reduction. Springer, Berlin.