



**AN EVALUATION OF FLOOD RISK COMMUNICATION EFFORTS BASED UPON THE VALUES JUDGEMENTS
OF THE INHABITANTS OF A SELECTION OF INFORMAL SETTLEMENTS IN THE CAPE TOWN MUNICIPAL
AREA.**

By

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Proposal submitted in partial fulfilment for the award of MTech in Environmental Management

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DECLARATION

I, Diana Tigere, declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

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ABSTRACT

It is widely believed that experts often have a more rational approach towards risks. This is because they are known to use algorithms, formal logic, risk assessments and normative rules to make decisions about risks. The central tenet of this research is that communication based on an understanding of how people conceptualise and evaluate risk communication efforts is critical for translating risk management knowledge into effective risk practices necessary for value generation in flood risk mitigation. Rational decision-making requires both analytic and intuitive systems to operate on a parallel level. Therefore, this research proposes a Flood Risk Communication Model that takes cognisance of lay perceptions. The model emphasises on how risk communication efforts are evaluated by the lay using a combination of descriptive psychological and social construction theories. In particular, the prospect theory, heuristics and biases, cultural theory and trust theory are used to provide explanatory sketches on how flood risk communication efforts are perceived in highly vulnerable environmental contexts such as informal settlements. The challenge in this research however, lies in verifying the model empirically. The associative group analysis technique will be used to generate empirical data from a case study population. Two basic analytic methods will be employed to measure psychological dispositions of respondents. Firstly, word associations are scored and weighted based on frequency of occurrence to generate a dominance score. The higher the dominance score, the greater the interpretation and the more meaningful the theme is for that particular group. Secondly, the different theories of the model are factored into a questionnaire to measure priorities. All the responses are then compared to the proposed model and also used to evaluate actual lay perceptions and feelings towards the current risk communication interventions. The results showed a high level of consistency with the FRCM and hence with the descriptive psychological models of Kahneman and Tversky. However, we conclude that what has been proposed to be biases are intuitive tendencies to adapt and make sustainable decisions in the face of applicable contextual influences. Thus, these contextual hierarchies determine the reference point and status quo of the recipient in decision making. Therefore, these influences and hierarchies need to be factored in the designing of a risk communication.

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CHAPTER ONE

1.1 Introduction

Flood risk has been a growing concern in the city of Cape Town mainly due to rapid urbanisation which has intensified as poor people tend to settle in flood prone areas (City of Cape Town, 2006:3-4; Ziervogel & Smit 2009:1). This is a problem which has been predicted to be further exacerbated by the impacts of climate change which will lead to an increase in extreme weather events including flooding (Mukheibir & Ziervogel, 2007:143-144). Out of the city's 3.4 million residents, 22.4% are estimated to live in informal settlements (City of Cape Town, 2009:6; 28). Most of these settlements are found in low lying, flat areas, characterised by high water tables and poor drainage and have thus been given the name 'cape flats' (Ziervogel & Smit, 2009:2).

Between the years 2004 and 2009, five to seven per cent (5 - 7%) of informal settlements residents were displaced on average each year in the July/August period. The worst flooding event to be recorded displaced an estimated 44 000 informal settlements households in 2001, which is approximately 13% of the total number of households in the area (Wood, 2009 in Smit and Ziervogel, 2009). And yet still, there has been an influx of people with the number of informal dwellings in Cape Town increasing from just over 23 000 families in 1993 to an estimated 109 000 by 2007 (City of Cape Town, 2009:27) despite the advocacy against settling in flood prone areas.

The dominant discourse in dealing with floods for informal settlements in Cape Town primarily focuses on improving stakeholder structures and social relations to ensure that flood risk management strategies are characterised by an understanding of exposure, vulnerability and shared stakeholder perceptions (Ziervogel & Smit, 2009:2). Stakeholders are typically taken to include civil society, Non Governmental Organisations (NGOs), advocacy groups, Faith Based Organisations (FBOs), social movements and trade unions, local authorities and government institutions (Ziervogel & Smit 2009:3). As a result emphasis has been duly placed on rehabilitating governance structures, an approach which is highly commended considering the historical injustices of apartheid, but a top down approach nonetheless which can be solely criticised for its lack of inclusion of non affiliated lay perceptions. According to Lebel, Nikitina and Manuta (2006:3-4), this lack of consultation and application of 'good

governance' criteria in managing flood risk has led to the public being considered as irrelevant in designing institutional responses.

Informal settlements have been found to be highly vulnerable to flooding due to their geography and location, as well as socio-economic conditions, of which the latter has often been quoted as being more debilitating than the former (Bouchard, Goncalo, Susienka & Wilson, 2007; Olorunfemi, 2011:1; 6-7). In terms of geography and location, most flood prone informal settlements are located in areas characterised by poorly drained sandy soils, high water tables, and flat land surrounded by mountainous areas (Ziervogel & Smit 2009:5). Poverty, impermanent structures, unemployment, low household incomes, poor service deliveries are all characteristics attributed to the socio-economic and physical status of these areas. Lack of sufficient modern storm water infrastructure, blockages of storm water drains further exacerbates the risk of flooding (Bouchard et al., 2007; Olorunfemi, 2011:7).

Theoretically, there is no flood that cannot be combated by hydro-structural and engineering means as proven by the case of Netherlands, but rather, the lack of money to build such structures is the inhibiting factor (Andjelkovic, 2001:2). This lack of finance has similarly contributed to the lack of success of the Cape Town's long term plan to build houses and relocate residents living in informal settlements (Muzondo, Barry, Dewar & Whittal, 2004:2; 7). In response, the City of Cape Town came up with a suite of flood risk communication efforts ranging from preventive to preparedness measures suitably planned to reduce flood risk and at the same time cheap enough to implement. As proactive measures, the city undertook to warn and educate residents about the possibility of flooding, encouraged relocation and upgrading of physical dwellings, and discouraged encroachment into high flood risk areas (City of Cape Town, 2008). However, Ziervogel and Smit (2009:7) still maintain that attempts to be proactive at reducing flood risk have been unsuccessful in the city of Cape Town.

1.2 Problem Statement

Much of the literature on flood risk management in the informal settlements of Cape Town seems to focus on the perceptions, judgements and evaluations of the expert towards flood risk (see Bouchard et al., 2007; Ziervogel & Smit, 2009; Olorunfemi, 2011) and issues of flood governance, while inadequate attention seems to be given to the social dynamics and value judgements of the lay. In this respect, Bier

(2001:139) and Rohrmann (2008:2) argue that risk communication messages may be constrained not only by legal and institutional policies, but also by audience characteristics. It is these values judgements that determine more often than not whether risk communication efforts are successful and whether the lay adopt expert judgement in flood risk management (Slovic, Fischhoff, Lichtenstein & Roe, 1981:17-18). Bouchard et al. (2007) highlights ineffective communication and a general absence of community involvement as two significant contributors to the lack of success of the City of Cape Town's flood risk management plans. Therefore, this research proposes to develop an explanatory model on the interrelationship between risk communication efforts, risk perception and behavioural patterns of Cape Town's designated "high" flood risk informal settlements and a framework upon which risk communication interventions can be evaluated.

1.3 Purpose of the study

The purpose of this study was to describe and explain the influence of flood risk communication efforts on the inhabitants of informal settlements of Cape Town and how this impacts on behaviours and perceptions towards floods. Furthermore, it is intended to investigate how these lay perceptions can be used to formally evaluate flood risk communication efforts, an approach which is more holistic in nature compared to the current method of using expert opinion alone in evaluating flood risk communication.

1.4 Specific objectives

1. To create a Flood Risk Communication Model (FRCM) that describes the interrelationship between flood risk communication efforts and flood risk perception and behavioural patterns of Cape Town's high flood risk informal settlements.
2. To verify the relevance of the model on a selected case study community.
3. To evaluate people's perceptions of the current flood risk communication efforts of the City of Cape Town.

1.5 Significance of the study

This study represented a first attempt towards formally evaluating the effectiveness of flood risk communication efforts in the city of Cape Town taking into account perceptions of the lay. It also brought forth a clear understanding of how recipients react to risk communication messages and created a platform upon which risk communication could be improved.

1.6 Research Questions

1. How do people living in areas designated as high flood risk informal settlements of Cape Town understand and evaluate flood risk communication efforts?
2. To what extent does the proposed Flood Risk Communication Model (FRCM) succeed in reflecting the layperson's evaluation of current flood risk communication?
3. Based on community perceptions how effective are the current flood risk communication efforts of the City of Cape Town?

1.7 Study Design

The study was conducted in 3 stages:

- (1) Written literature was reviewed to create a model that could be used to describe and explain how residents of high flood risk informal settlements react to flood risk communication and ultimately form perceptions.
- (2) A case study of a 'high risk' flood prone community was used to verify the model through questionnaire surveys to generate qualitative primary data.
- (3) Results of the survey were used to evaluate the current risk communication efforts of the City of Cape Town.

1.8 Theoretical Basis and Foundations

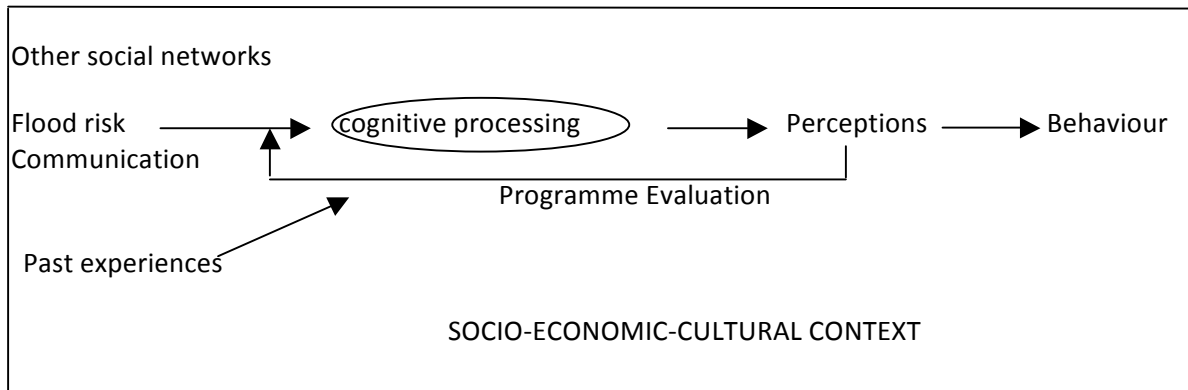
Principles used in this study stemmed from a combination of phenomenological and social constructivism approaches. The phenomenological approach has its foundations in clinical and

phenomenological psychology and emphasises on the subjectiveness of perceptions. On the other hand social constructivism has its origins in social psychology, sociology and cultural anthropology. It postulates that reality is a social construct and a product of group dynamics.

1.8.1 Conceptual Framework of the research

The conceptual frame work was a product of integrated contextual approaches used in risk communication of natural hazards which include: prospect theory, heuristics and biases, social networks, social trust to create the model outlined below (Figure 1.1).

Figure 1.1 Flood Risk Communication Model (FRCM)



- The reaction or behavioural pattern of any individual or a group of individuals to flood risk communication will depend on the perceptions and circumstances of that individual or group of individuals at that point in time.
- Information search and social networking reflects a process of identification where individuals both consciously and unconsciously seek for information related to the risk communication. Sources of information range from friends, family, written records and small organisations depending on the unique circumstances of the individual.
- People will also embark on personal past experiences in terms of frequency and intensity of previous flooding events in a bid to weigh the relevance of the risk communication. The greater the intensity, frequency and damages incurred in the past, the greater the reaction and the lesser the level of tolerance to flooding in the future.

- Flood risk perception is therefore a combination of past experiences, the level and quality of information available in social networks, the risk communication itself and the socio-economic-cultural environment of the target population. This will in turn determine the level of tolerance and the reaction of the people to flood risk communication.

Consequently, the impact of any flood risk communication will be determined by the perceptions of the people concerned and should be evaluated accordingly.

1.9 Population and sample

Purposive sampling was used to select the case study population. The case study population was a flood prone informal settlement ranked to be of a 'high risk' priority in terms of flooding according to the City of Cape Town. Non-probability convenient sampling was also used to select respondents. The case study area determined the number of questionnaires distributed. Convenient sampling points were determined by spheres of influence of service centres in the case study area.

1.10 Investigative techniques

The survey questionnaire employed a combination of the AGA (Associative Group Analysis) technique as well as likert scale, and multiple-choice questions for cognitive mapping and to generate qualitative data on the mental models of high flood risk informal settlement dwellers. This AGA technique was chosen because it allows the measurement of psychological dispositions and therefore perceptions without the bias of the respondent knowing the actual measurement that is being explored. Respondents were asked to write down word associations in response to a particular stimulus word or theme. Multiple-choice questions with different scenarios were tested for framing effects and individual priorities. Perceptions, and ultimately behaviour were used, as dependent variables whilst socio-economic-cultural backgrounds, social networks, risk communication and past experiences were independent variables.

1.11 Instrumentation

Data collection materials were tailor made for this specific study. Facilitators were made available with instructions to guide the respondent on how to answer the questionnaire. The survey was filled in by the respondents to obtain qualitative data on word associations and respondent socio- demographic information such as age, gender, ethnic background, education and employment respectively.

1.12 Data analysis plan

All the data collected was coded and entered manually into Microsoft Excel spread sheet. Descriptive statistics were used to analyse the data. Word association questions were firstly scored and weighted based on frequency of occurrence and stability of responses. Independent judges were used for content analysis utilising semantic designations and attributions to code and categorise the data into domains. The total scores for all the responses per given domain were then calculated to get the dominance score. The higher the dominance score, the more meaningful the domain was for the population. This generated sufficient descriptive statistics on behavioural patterns and perception to compare in terms of tendencies to conform to the proposed model as well as reflected the effectiveness of current methods of risk communication.

1.13 Limitations

This study is presented in the context of informal settlements in the cape flats designated as 'high risk' according to the City of Cape Town. The results only represented the respondents who are residents in the targeted area, though similarities with other areas with similar problems and composition could be expected.

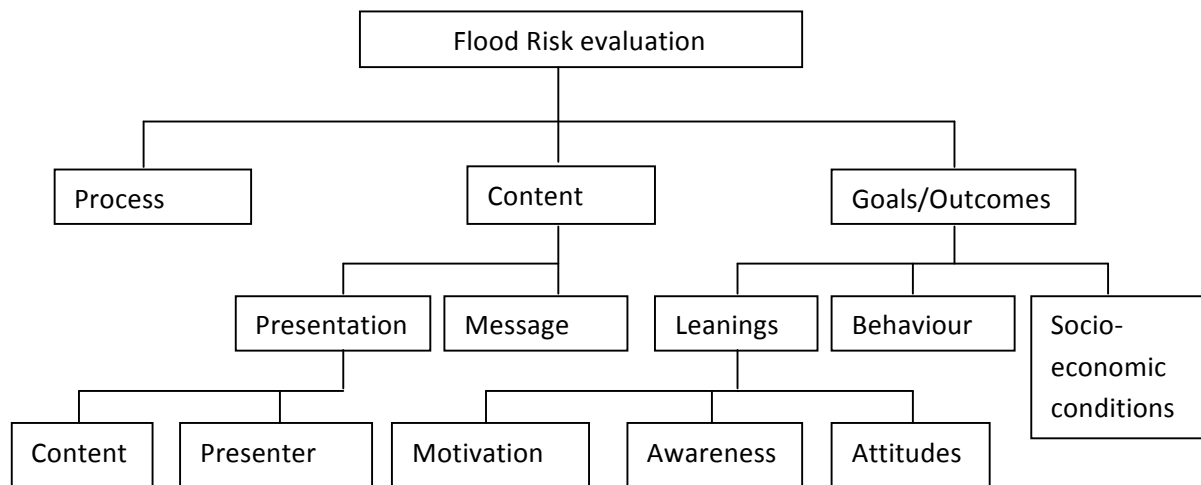
1.14 Ethical considerations

Participation was voluntary. Data collection instruments were coded and no respondent identities were captured in the database to maintain respondent anonymity. As participation was voluntary and no clinical trials were involved, ethical implications were reduced to confidential treatment of the data. As this survey measured psychological dispositions, before the commencement of the data collection, voluntary consent by the respondent needed to be granted. A consent form was attached to the questionnaire for this purpose.

1.15 Dendogram for literature review

Below is a diagrammatical representation of the flow of literature review followed in this research. The literature review will be covered in the next chapter.

Figure 1.2 Dendogram of literature review



CHAPTER TWO

2.1 Introduction: flooding as a risk in risk management

Risk management involves three different public policy strategies, namely (i) risk identification, (ii) risk reduction and (iii) disaster management (Cardona, 2003:2). Risk identification takes into account perceptions, social representations and objective estimations. As such, risk is a highly topical term by both denotation and connotation, and according to Rohrmann (2008:2), this can be attributed to the fact that the sources of risk are many and varied, and therefore heterogeneous; while according to Fischhoff, Watson and Hope (1984:124-126), this controversy is due to its dimensionality and objectivity. In order to better understand the concept of risk in flood risk management, it is appropriate to trace the paradigm shifts that have occurred in the past few decades. There are two dominant discourses that determine how flood risks are viewed. On one end of the continuum are the engineers, geographers, geologists and epidemiologists who believe that flood events can be measured and objectively quantified (Cardona, 2003:2-3), a view that is termed objectivist. Prior to the 1960s this approach dominated much of the flood risk management policies and led to geophysical and technical approaches as solutions to the problem of flooding. Yodmani (2001:1) believes this was probably because at that period, floods were once off events. On the opposite end of the continuum are the 'constructivists' who consider risk to be a social phenomenon (Yodmani, 2001:1; Cardona, 2003:2-3; Ziervogel & Smit, 2009:3). The latter discourse is dominated by psychologists, sociologists and historians who believe that understanding risk requires knowledge of individual perceptions and social interactions (Cardona, 2003:2-3). To date it seems that the constructivist view is gaining momentum, especially with the realisation that between the 1960s and the 1990s, there was an exponential increase in the economic losses and deaths from flooding events without any clear increase in frequency, and at the same time, variations were discovered across regions, cities, continents, socio-economic classes and even gender (Yodmani, 2001:1-2). In the present decade, the issue of climate change that is predicted to increase the frequency of extreme weather events including floods has compounded this.

2.1.1 Risk communication in flood risk management

Risk communication plays a critical role in risk management (Hagemeyer-Klose, 2007:1). It involves dialogue about the characteristics, causes, degree, and the significance of uncertainty, controllability and overall perception of a risk, (Palenchar & Heath, 2007:121) and in this case, a flooding risk. Any population exposed to hazards needs to be optimally informed about the risk, methods for reducing the risk, and how to properly behave if the risk is realised. Clearly, risk communication forms an indispensable link between the public and risk managers. Rohrmann (2008:1) defines risk management as ‘...manifold procedures for reducing risks (either the hazard itself or its consequences) to a level deemed tolerable by society, this includes monitoring, control and public communication’. Burns (2007) also agrees with this definition as he defines risk analysis as a process that consists of assessment (identification and quantification) and management (communication and mitigation). The history of risk communication in risk management can be interlinked with the turn of the industrial revolution as people raised concerns about technological risks such as nuclear power and genetic engineering compounded with the limited success of safety campaigns (Rohrmann, 1992). The sociologist, Ulrich Beck in his book ‘risky society’ in the 1980s, predicted that this accelerated technological change such as in the field of biotechnology will not only provide great hope for the future, but will evoke great fears of unknown threats (Habbeger, 2006:13). Thus such issues, although classified under technical and scientific character, tend to reflect social concerns and it is therefore critical for the response be more social than technical. Indeed, such issues were dealt with through governmental and industrial liaisons, which led to the postulation of regulations. However, public outcry opposed this two party relationship and this brought forth the technocratic attempt to pacify the public through ‘objective’ solutions towards risk which were interlinked with concepts such as ‘acceptable risk’ and ‘risk benefit analysis’ (Baker, 1990:343). This marked the beginning of the criticism of the technocratic view in the field of risk analysis. Alaszewski, (2005:101-102) identifies two competing approaches to risk. In the first approach, risk is an objective phenomenon that can be managed with appropriate technology (structural), while in the alternative approach, risk is a subjective phenomenon, socially constructed and embedded with specific social situations and relationships, and can be prevented or minimised. In retrospect, floods were deemed government responsibility and the communities at risk merely demanded protection. However, bearing in mind that the ultimate goal of flood prevention is to improve the quality of life by reducing the negative consequences of flooding (Andjelkovic, 2001:5) and harmonising the coexistence of human beings and natural hazards, there has been a shift in policy and attitude and a move towards

creating flood resistant communities in flood risk management (Cashman, 2011:35). Furthermore, technically speaking, meeting such expectation is feasible, assuming there is no flood that cannot be mitigated, but rather cost is the limiting factor. This is especially true in developing countries where emphasis on the role played by individuals and communities in flood mitigation can spell life or death situations, and this calls for effective risk communication to the public (Andjelkovic, 2001; Cashman, 2011).

Considering that all forms of risk assessments (i) include some form of subjective judgement no matter how objective they may seem (Slovic et al, 1981; 17-18); (ii) regarding this fact judgements are prone to limitations and distortions due to their inherent nature of being subject to different participants, and (iii) the public brings its own mental model of flood risk, risk communication becomes prone to conflicts. Agreement on basic terms about risk is brought about by effective communication on the part of both the experts and the lay (Fischhoff et al., 1984:123-124). Effective communication enables communities to take action or change their behaviours, thereby reducing exposure to hazards and societal harm (Alaszewski, 2005:101). Risk communication becomes especially important given the following summary of the philosophical definitions of risk:

- Subjective risk: *the mental state of an individual who experiences uncertainty or doubt or worry as to the outcome of a given event.*
- Objective risk: *the variation that occurs when actual losses differ from expected losses.*
- Real risk: *the combination of probability and negative consequence that exists in the real world.*
- Observed risk: *the measurement of that combination obtained by constructing a model of the real world.*
- Perceived risk: *the rough estimate of real risk made by an untrained member of the general public (Althaus, 2005).*

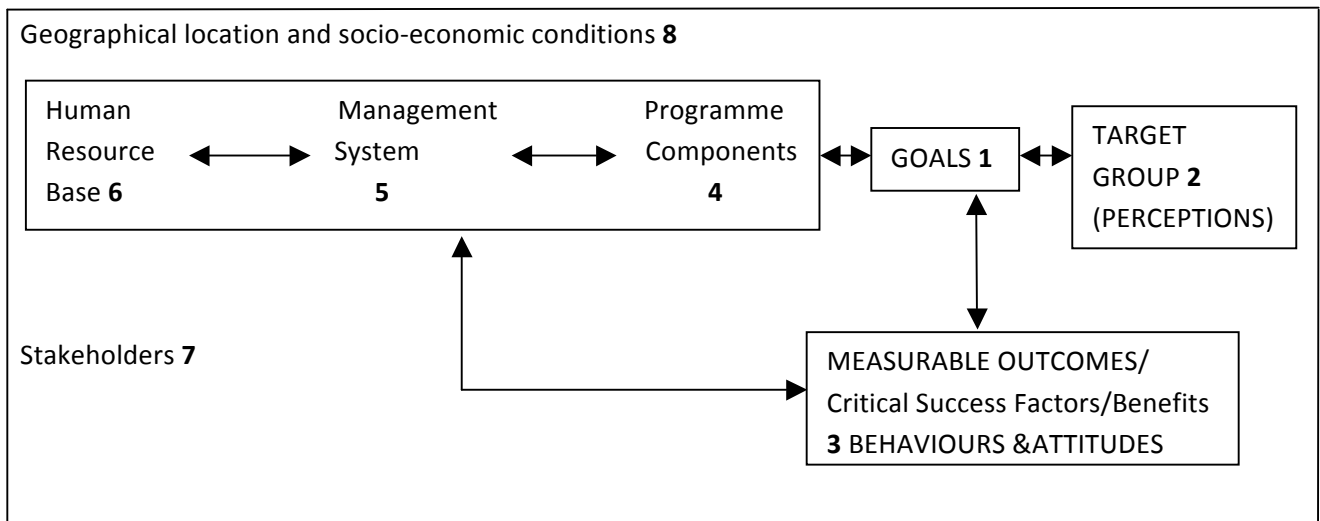
For effective flood risk management, risk communication between residents, local communities, government agencies and other stakeholders is indispensable.

2.2 Evaluating flood risk communication

Communication about the manifold sources and consequences of risk to the individual and society has become a crucial, albeit, difficult task which includes aspects of risk perception, management and evaluation (Rohrman, 1992). Risk communication is critical because not all environmental hazards require direct governmental interventions such as air pollution regulation; rather, some hazards require voluntary action from target populations for instance dealing with floods (Baker, 1990:343). Differences in perceptions have been claimed to be at the core of many conflicts and communication failures (Weber & Hsee, 1998:1205), but whereas a lot has been studied and is known about risk perception, risk communication evaluation on the other hand contains very little research especially with reference to natural hazards. To date rather few evaluation projects on risk communication have been carried out (Benson & Twigg, 2007: 154). The few that are available have a particular focus on earthquakes and volcanicity (Grothmann & Reusswig, 2006; Terpstra, Lindell & Gutteling, 2009). Risk communication is an umbrella term for social interventions such as programmes, projects and policies aimed at changing attitudes and behaviours pertaining to particular risks. According to Babbie and Mouton (2001:342), we only intervene when we believe that the 'normal' course of events is not being followed. But who actually defines what is considered normal and what is not? Let us use the conceptual framework below (figure 2.1) to answer this question as well as to define the relationship between risk perception, risk communication and risk communication evaluation, which are the main components of this research.

According to Babbie and Mouton, (2001:343) since a programme (4; 5; 6) is designed to meet the needs of a particular target population, the perceived or real needs of that population (2) should determine the goals of that risk communication effort (1). The programme should also be evaluated according to measurable outcomes such as behaviours and attitude. Of course, all these steps can be influenced by the environment or context under which the population resides and the programme implemented such as geography and socio-political and economic status.

Figure 2.1 Conceptual framework of evaluating interventions



There are many different tools and formats of risk communication and it has been the centre of debate as to which format is most effective (Höppner, Bründl & Buchecker, 2010:22). Benson and Twigg (2007:154) attributed the lack of progress to institutional and methodological processes, while Fisher, Pavlova and Covello (1991) attribute it to conflicts and disagreements on values, goals, resources and usefulness. Bier (2001:139) also points out that determining what constitutes success in relation to risk communication is not straight forward because the measure of success will vary depending on the effort and purpose of the risk communication. Bier goes on to give a good example of a program that is aimed at educating teenagers about risks of unsafe sex, but omits to focus on taking protective action. The program becomes a success on an educational basis but has failed as a motivational effort. Habbeger (2008:17) also analyses the concept of risk in its multiplicity of goals in association with a society that needs to break away from its past and in which decisions are associated with goals, interests and values. Indeed, all the above analysis forms the basis and criteria upon which evaluations can be measured. Going back to the literature on evaluation, the concept has been defined as:

1. *An assessment as systematic and objective as possible, of an on-going or completed project or policy, its design, implementation and results (Benson & Twigg, 2007:153).*
2. *Assessment of the content, process and effects (consequences, outcomes, impacts) of an intervention (measure, strategy or program) and the appraisal according to defined criteria (goals, objectives, values) (Rohrmann, 1992).*

3. *...the systematic application of social research procedures for assessing the conceptualization, design, implementation and utility of social intervention programmes.*(Rossi & Freeman, 1993:5 in Babbie & Mouton, 2001:335).

Clearly, all these definitions have three aspects in common; goals and impacts, implementation or process and content and design all of which represent the criteria upon which an intervention can be merited. The number of evaluation classes varies from literature to literature for instance Rossi and Freeman (1993) in Babbie and Mouton (2001:335) identify three classes: conceptualisation and design; monitoring and implementation; effectiveness and efficiency while Posavac and Carey (1991) in Babbie and Mouton (2001:335) identify four classes; need, process, outcome and efficiency. Although the number of classes differs, the aspects under evaluation are basically almost the same. In essence, process evaluations measure and assess the program itself (WHO, 2000:8). It is also known as implementation evaluation (Bowie & Bronte-Tinkew, 2008:1) and examines the extent to which a program is operating as intended. It aims to establish points of improvements. Content evaluation refers to the message and presentation (active ingredients) and their validity in comparison to the goals of the communication (Rohrman, 1992). It investigates into whether the message meets the information needs of the receiver or not. However, process and content evaluations will not be dealt with in this research.

2.2.1 Evaluating flood risk communication effectiveness

Rohrman defines effectiveness as the degree to which an initial situation, which is unsatisfactory, is changed towards an intended state in relation to goals as defined by the program (Rohrman, 1992). Stemming from the methodological perspective, the criteria for evaluating effectiveness of an intervention is therefore based on instruments used in the method of application of the intervention such as the content of the method, the process followed in the method and the outcomes of using that particular method.

Outcomes can be defined as expected changes (preferably beneficial) for communities or individuals due to their involvement with a specific project or program (Hodgert, 2007:5). In essence, outcome evaluations measure the results obtained from risk communication efforts. The degrees to which

beneficial results are obtained reflect the effectiveness of the program. Outcomes can be divided into 3 categories:

| Learnings | Behaviour | Conditions |
|------------------|------------------|-------------------|
| Awareness | practice | social |
| Knowledge | decision making | economic |
| Attitudes | policies | environmental |
| Skills | social action | civic |
| Opinions | | |
| Aspirations | | |
| Motivations | | |

Source: University of Wisconsin, cooperative extension, Programme development and evaluation, in (Hodgert, 2007:5).

It is important to note that risk communication evaluation is by nature a normative and values-laden process with political, ethical and practical implications. This is as a direct outcome of the multiplicity of stakeholders involved from the top professional and government agencies to the lay community and individual persons. Each of these stakeholders has different, often conflicting values, interests and perspectives which impact on the effectiveness of the risk communication effort (Fisher et al., 1991). Each individual, group or institution has a set of outcomes that they expect to be realised from an intervention. This affects the criteria upon which a programme can be measured. This leads to another problem affecting the evaluation of risk communication: formulating risk' communication goals.

A clear set of goals and objectives before any risk communication action takes place is of paramount importance (Bostrom et al., 1994:789). Goals and objectives determine the criteria upon which outcomes can be measured. The barrage of literature on risk communication seems to have reached a consensus on the goals and purposes of risk communication. Some risk communication efforts are content with informing the public about decisions made, some aim to reassure the worried, others attempt to change behavioural characteristics of the audience (Rohrmann, 1992; Bostrom, Atman, Fischhoff & Morgan, 1993; Bier, 2000; Benson & Twigg, 2007; Höppner et al., 2010) while others aim to impart knowledge and skills. Other generalisations include increasing public awareness, educating the public, encouraging protective action, conflict resolution and changing attitudes. While Hodgert (2007:5) condenses hers into learnings, behaviour and conditions, Rohrmann (1992) groups his into changing knowledge and attitudes, modifying risk related behaviour and facilitating cooperative conflict resolution.

Outcome evaluation can be done in one of three forms: randomised controlled trials that are scientifically rigorous, comparison groups less scientifically rigorous or pre-post comparison (Rohrmann, 1992). Although the latter is the least scientifically rigorous of the three, it is much more realistic and usually employs the use of indicators such as the number of people who are acutely aware of the risks of flooding as compared to baseline data or other statistics such as mortality rates and thus, it is more prominent in risk communication evaluation literature (Rohrmann, 1992). *This research will critically focus on outcome evaluation and will be based on the assumption that a good program should improve the receiver's comprehension, knowledge and awareness as ultimately reflected in the perceptions, attitude and behaviours of that recipient (Baker, 1990; Rohrmann, 1992).*

2.3 Elements of the evaluation

It is important to note that risk perceptions and attitudes are reviewed as only possible and not actual determinants of behaviour. Perceptions only serve to steer decisions about acceptability of risk and are highly influential in risk related behaviour. Actual or observed behaviour is not necessarily the direct influence of perceptions and attitudes (Rohrmann, 2008:3).

2.3.1 Perception

Risk management consists of decision processes and actions constructed by individual perceptions of risk. For effective risk communication a sound understanding of risk attitude and perception is indispensable (Rohrmann, 2008:3). Grothmann and Reusswig (2006) made an attempt to explain the variance in precautionary action taken by residents in the flood prone areas of Germany in order to prevent flood damages. In their study a comparison was made between the subjective socio-psychological model (the Protection Motivation Theory) based on threat experience, threat appraisal (risk perception) and coping appraisal and the more traditional and objective socio-economic model (age, gender, ownership, education etc.). Results generated showed that socio-psychological factors have a higher explanatory power than the objective models as to why some residents take precautionary action against floods and why others do not. Similarly, Richardson, Reilly and Jones (2003:4) in a different study made an observation that the most effective means of risk communication

will tend to vary depending on the target audience and their circumstances and these differences should not be attributed to a lack of understanding but rather to differences in perceptions. How people (both experts and non experts) perceive risk, understand its probabilities, evaluate gains and losses, compare implications of various alternatives, consider values and finally decide whether to mitigate or accept the risk varies across cultures and communities, households and individuals (Morrow, 2009:11). No risk is judgement free and all judgements are perceived. In line with this theory, Morrow (2009:11) writes that it should not be considered irrational when people receive information from a variety of sources in addition to the experts. Risk perception is constructed from individual experiences and beliefs based on psychology, economics, social and institutional factors (Heitz, Spaeter, Auzet, Glatron, 2009:444). In this light, risk perception becomes a function of the 'experiential' system; made up of feelings, emotions, and values we have gained through experience, including the experiences from our social networks (Morrow, 2009:13-14) and 'analytic' systems (risk communication). Perceptions are therefore at the core of risk decisions and should form the basis of any risk communication, and should thus be used to evaluate risk communication programs. Richardson et al. (2003) further expounded that some individuals are in denial of the risk for personal and financial reasons while those who have never suffered the risk did not appreciate it fully. Contrary to these findings, Takao in his study of the Tokai flood disaster in Japan (2004) argues that past experience does not necessarily determine one's preparedness or awareness towards floods. In pure scientific terms, people use availability heuristics to determine the recurrence of a particular event, such that if vivid memories are readily available, the probability of that event recurring is rated as high (Patt & Schröter, 2008). On the other hand, prior exposure may lead to a falsely optimistic bias based on the assumption that the frequency of the flooding and the losses will always be the same, thus lowering the risk perception and decisions made to combat that risk effectively (Coulston & Deeny, 2009:293-294). Takao rather attributes preparedness for floods to emotional factors such as fear, not necessarily towards the hazard itself, but rather towards the potential to incur a loss from damages to property. Hypothetically speaking, the decision to relocate from a floodplain to higher ground so as to avoid the devastating effects of flooding entails the loss of sources of livelihoods such as farming and the loss of community ties thus hampering the incentive to move from a high risk situation. This propensity to take no action that will lead to a change in the current status or set of risks (Patt & Schröter, 2008) is known as status quo. In line with Takao's findings, Miceli, Sotgiu and Settanni (2008:165) and Xie, Wang, Zhang, Li and Yu (2010) maintain that the results of most empirical research examining the relationship between risk perception and risk preparedness show either low or null correlations due to the fact that operational definitions of risk perceptions used

so far fail to sufficiently account for the role played by emotional processes involved in probability judgements and their impact on the adoption of protective behaviours. Emotions refer to the different mental and physiological states that individuals undergo and can be categorised in a variety of ways based on valence, intensity, duration etc. In risk analysis literature, most of the emotions encountered are of loss based and ethical origin. The latter includes anger, outrage or guilt and mostly originates from technologically based risks while the former is prone to be found in the field of natural hazards and includes feelings of fear, worry and sadness (Xie et al., 2010). Thus failure to take cognisance of the role of emotions in judgement and decision-making can undermine the efforts of effective risk communication. It should be realised that, 'some emotions can create so called mental noises with a person's ability to engage in rational judgements, bias the information inquiry and processes, and hence produce barriers to effective risk communication' (Xie et al., 2010). Accordingly, Miceli et al. (2008:165) carried out a study in the alpine region of Italy to investigate preparedness and risk perception and found out that there was a strong correlation between perception of flood risk and disaster preparedness. The difference between Miceli et al. study and previous literature was the inclusion of both cognitive and rationalist components, which characterise the theoretical construct of the perception of risk inclusive of both emotional and affective ones.

As (Fisher et al., 1991) wrote, one difficulty in any evaluation study is determining the perspective from which the evaluation will be conducted. Hence, the two way relationship (feedback mechanism) between risk communication and risk perception should be acknowledged since only perceived risks are communicated and communication has a profound influence on the perception of risks (Hagemeyer-klose, 2007:1).

2.3.2 Awareness

Risks can be proactively and effectively managed if awareness is created amongst the general public in the first place (Richardson et al., 2003). The concept of awareness stems from the field of cognitive psychology and has far reaching definitions and theories but for the purposes of this study, awareness shall be considered in simpler terms as synonymous to consciousness, and as a function of sensations such as touch and vision (Strong, 1939). Flood risk awareness determines the effectiveness of flood management strategies. This is because it forms the basis upon which the populations deemed to be 'at

risk' construe flood risk. Burningham, Fielding and Thrush (2008) categorise flood risk awareness into three components: consciousness of living in a flood prone area, awareness of flood warning procedures and consciousness of various actions and behaviours to be taken in the event of a flood having occurred. Contrary to this definition, Knocke and Kolivras (2007) identify literature based on a study in Hawaii where it was proven that awareness of volcanism did not necessarily translate into either knowledge or behaviour. However, it still remains that awareness is critical as a precursor for self-protective behaviour especially for those populations living in flood prone areas (Coulston & Deeny, 2009; Dominey-Howes & Minos-Minopoulos, 2004). Effective risk communication should therefore make a distinction between information dissemination and creating risk awareness (Hagemeyer-klose, 2007).

There are two basic models to creating flood risk awareness, the more traditional deficit model and the more recent contextual model (Burningham et al., 2008). The deficit model has been extensively criticised by sociologists because it quantitatively identifies the percentage of the population exposed who are deemed unaware then educates them through awareness campaigns. The main thrust of this model is information dissemination to fill in the gaps and thus meet the awareness deficit of the study population. The main drawback of this approach is the action-awareness gap that is created. Although it is of paramount importance that the knowledge gaps of communities are filled, it is of even greater importance that the knowledge be easily translated into risk avoiding actions. Contrary to this deficit approach, the contextual model acknowledges the varying practical and social contexts of the 'at risk' population and how expert analysis and information is likely to be evaluated by this population under the prevailing socio-economic and socio-psychological conditions. In short, the 'at risk' population is viewed as an active population as opposed to passive recipients of information. It has been proven that awareness campaigns that take cognisance of the various social values and perspectives tend to be more effective in creating awareness (Burningham et al., 2008). These social values reflect the gap between lay and professional opinions. For instance a study in Colorado cited in Knocke and Kolivras (2007) identifies how flood risk awareness varies by demographic group, while, Eriksen and Gill (2010) refer to aspects such as costs, gender and other everyday life priorities. Thus, the quantitative analysis of flood risk awareness should dwell on other aspects that affect flood risk awareness such as social class, previous flood experience and stigmatisation, length of time in residence, emotional attachment and lack of information. Eriksen and Gill (2010) made an attempt to study the awareness-action gap on bushfires in Australia based on the notion of 'everyday' life and discovered that the gap existed due to conscious choices made by landowners. Therefore natural hazards such as floods and bushfires should

not be considered merely as natural phenomena but simultaneously as trade-offs in the juggling of daily procedures and dilemmas between social, cultural, environmental and economic issues. Thus, official rationality did not translate well into landholders' priorities in everyday life. In total agreement with this notion, Burningham et al. (2008) identified how experts in the UK see flood risk as an identifying characteristic of an area, while this factor did not even remotely register as significant for the layperson.

2.3.3 Attitudes

Although a lot of studies have been carried out on risk and risk perception, not much has been done on risk attitude especially in relation to natural hazards (Rohrmann 2008:5). This lack of sufficient literature can be attributed to the contextual nature of risk in terms of domain specificity (e.g. health, finance etc.) and to a lack of clear cut attitude measurement procedures such as response modes or question framing (Pennings & Smidts, 2000). The few studies that have been carried out so far originate from decision processes, social psychology and personality model contexts. In this study, the definition of risk attitude will be taken from Rohrmann who identifies two facets of risk attitude: risk propensity and risk aversion. These facets are not distinct or stand-alone but rather they can be described as two poles of a one-dimensional mind-set. Rohrmann defines risk propensity as intentions or mind-sets towards taking risks and risk aversion as intentions or mind-sets towards avoiding risks, and risk attitude itself as a term denoting 'people's intentions to evaluate a risk situation in a favourable or unfavourable way and to act accordingly' (Rohrmann, 2008:5). Various literature argue as to whether cognition, affect and behaviour are the basis from which evaluative summing is derived as opposed to being constituents of attitude (Milfont & Duckitt, 2010). Weber and Hsee (1998) carried out a number of studies in different countries to measure cultural differences in risk preference behaviours. The differences in risk preference that were discovered were mainly associated with differences in perception rather than with cultural differences in attitude where all the cultures were found to be risk averse. This study clearly mirrors the controversy between the differentiations of the concepts of attitude, perceptions and behaviours and therefore the close relationship between these concepts.

2.4 Conflicts of risk perception, risk communication and risk management

From the introduction given in the preceding sections of this chapter, it seems that, perceptions, awareness and attitudes are all latent constructs of psychology and are therefore, difficult to measure and observe directly. Rohrmann (1992; 2008:4) recommends the use of process models in order to better conceptualise and grasp the interpretation of these elements in evaluation studies. The use of modelling dates back many years ago as decision makers employed formal models to explain phenomena and aid decision making under conditions of risk and uncertainty. The model is first used to capture the structure of the problem; experts are then employed to weight and calculate probabilities, and the best course of action is determined (Fischhoff & Goiten, 1984:505). This is likened to what Slovic et al. (2004:1) describes as risk as analysis. It brings reason, logic and scientific deliberation as conceptualised and perceived by the decision maker to bear on hazard management (Fischhoff & Goiten, 1984:505; Slovic et al., 2004:1-2). This also marked the beginning of conflicts in risk management. According to Renn, (2003), there are different types of conflicts in the scientific realm which also prevail in risk communication as outlined below:

2.4.1 Cognitive conflicts

Revolve around scientific facts and evidence, where it becomes difficult for the public to constructively analyse and interpret scientific terms and data such as probabilities, frequencies and magnitudes. This is especially prominent in natural hazards such as climate change and floods. For instance, in climate change, Fischhoff and Furby (1983:180) assert that, “We are all in trouble if the climatologists seriously understate or overstate how much they know. How such assessments are made, by consumers, legislators, diplomats or scientists, would seem to be eminently psychological questions.” At this level, the function of a risk communication is to provide factual knowledge including the treatment of uncertainties and ambiguities (Renn, 2008:82-83). The level of accessibility to audience, comprehensibility and the acknowledgement of framing problems can evaluate this. It seems that these cognitive issues have resulted in what has now come to be known as expert vs. lay debates, analytic vs. intuitive perceptions of risk, or objective vs. constructed risk. At the core of these debates is who determines what constitutes an expert and a non-expert, is it the government officials who use scientific knowledge to communicate about a particular risk, or is it the individual on the ground that has actually

experienced the risk in the past? Plapp (2001:2) argues that decisions about risk management should not be left to managers alone but should include populations living in the exposed area since their perceptions form the basis of their responses to natural hazards. Therefore, it can be concluded that for the development of effective risk communication and risk management strategies, the perceptions and influences on perceptions of target group is imperative (Fischhoff & Furby, 1983:181) especially considering the fact that scientists themselves are unable to reach a consensus, their answers are oriented towards different specialisations and have a tendency to change over time. The latter also explains why trust issues play a role in cognitive debates (Wachinger & Renn, 2010:32). Understanding the subjectiveness of risk perception should be considered a pre-condition in any risk assessment.

2.4.2 Evaluative conflicts

Evaluative conflicts revolve around uncertainty issues and ignorance brought about by risks not being facts but rather calculated probabilities. Apparent precision of numerical probabilities usually disguises the fact that they are all estimates whose reliability depends on randomness of the events under consideration, quality of data available, and processes and assumptions used to derive estimates, which are all uncertain (Eiser & White, 2005:4). They are prominent amongst both experts and non experts. The most important factor in this category is the nature of the hazard under consideration. Natural hazards are harder to predict when compared to technological hazards because they are subject to perceptions of probability and magnitude; perception of time scales; perception of jumps, extreme events and delay effects; perception of complexity and perception of uncertainty (Wachinger & Renn, 2010:21-29). Rational analysis and scientific experiments rely on the assumption that experiments can prove causality by the isolation of stimulus and response, and still be reproduced or replicated in a different location and at a different time. This assumption does not hold water for most natural hazards. Natural hazards are complex and non-linear, with multiple causes and effects. For instance floods can change in intensity and frequency due to climatic change factors such as temperature, rain, thaw or manmade adjustments. Natural hazards also differ in time scales and can be forecasted sometimes over hundreds of years upon which investigations and risk assessments must be undertaken making them difficult to comprehend for both experts and non-experts. Discontinuities on the time scale are also prone to occur such as latency (delay effects over time) and jumps (sudden extreme events when the risk level was considered low a short time ago) (Wachinger & Renn, 2010:26). For example, floods can

occur over a short period of time due to rain while droughts can take longer to occur after the initial weather event such as an increase in temperature for a specified duration. This makes natural hazards even harder to perceive. Even worse, natural hazards can lead to extreme events, which have been often described as for example, the 'worst' floods in the past century etc. Small changes in environmental parameters can trigger massive changes in the natural hazard unlike linear systems; hence, they are often described as extreme. The definition of extreme varies within disciplines and from individual to individual and is subject to perception. In this respect, the ability to predict, imagine and control natural hazards becomes markedly reduced. Because we can only predict their onset and effects to a certain extent, they become uncertain in every way. For instance climate change is an uncertain phenomenon often treated by some experts as non-existent as evidenced from its lack of consideration in certain policy issues, such that, not all countries are signatories of the climate change convention e.g. the United States has not ratified the Kyoto protocol (Fischhoff & Furby, 1983:180). This is in line with Eiser and White (2005:5) who claim uncertainty to be a frame of mind; the numbers don't matter but our feelings towards them.

2.4.3 Interest conflicts

These are the most prominent amongst all stakeholders including the public. For experts it concerns costs and benefits associated with choosing a particular management option, for the public however, the conflict is deeply rooted in costs and benefits associated with value systems, culture and beliefs (Renn, 2008:84-85). It is obvious that experts are always trying to prescribe the extent of their expertise to the public. This expert orientated tradition has been criticised from experimental psychology, which argues that the determination of the definition of risk should not be the exclusive province of scientists; rather, it should explore the opposing role of judgements of fact and judgements of value and take cognisance of non-expert perceptions as well (Fischhoff & Goiten, 1984:505). Looking at this from an evaluators' point of view, understanding the reasonableness of the decision makers' course of action requires an understanding of how they personally view the information, simply put, how the decision maker perceives the risk. Finding a common definition of risk between the lay and the expert requires that the risk communication capture the needs of the audience (Renn, 2008:84-86). The legitimate intention of the communicator needs to be reconciled with the equally legitimate concerns and perceptions of the recipient. Wachinger and Renn (2010:16; 36) maintain that although a specific

location or context generates certain risks, it can also generate certain benefits. Although settling in informal settlements exposes people to flooding risks, there are also potential benefits such as the economic viability of the area in terms of free or cheap accommodation, a benefit that is much more pronounced if one is unemployed or has a low income. Empirical evidence can be seen in the case of the Chernobyl nuclear reactor where people were more concerned about losses of sources of income as opposed to health concerns. Wachinger and Renn (2010:17) also go on to explain how other factors may influence risk perception such as feelings of being connected to a particular place or being affiliated with a certain context as part of your identity.

2.4.4 Value conflicts

Although they overlap with interest conflicts, value conflicts are more concerned with ethical and moral issues and involve advocacies about minority groups and human rights.

2.4.5 Procedural conflicts

Are expert oriented and pertain to design and implementation of interventions. Automatically, any formal risk analysis model can be criticised for bearing the needs of the decision makers' benefits to be foremost in mind. A clear example is from Fischhoff, Slovic and Lichtenstein (1982:240) on technological risks, they assert that, discussions on managing technological risks is full of speculation about human behaviour, what they want, know and are capable of understanding but without any hard evidence or facts to back it up, thereby granting the decision maker considerable political clout. This clearly argues the role of institutions in making formal models and how they can typically lead to inappropriate decisions (Fischhoff & Goiten, 1984:505). When experts put forward models, it requires the exercise of judgement, even though this judgement comes from a trained expert; it is a judgement nonetheless (Fischhoff et al., 1984:124-125). Realistically speaking however, it is no easy task either, to theoretically conceptualise and build models of a public who can be sometimes be risk seeking and sometimes risk averse (Fischhoff et al., 1982:240). This brings forth another contradicting tradition from experimental psychology: peoples' systematic intuitional biases in judgement especially in the face of uncertainty (Fischhoff & Goiten, 1984:505). Again from an evaluators' point of view, to eliminate intuitive biases, the

role played by intuitional judgement should be minimised and be considered 'irrational' and the role of formal methods in modelling risk should play a key role, after all, risk characteristics such as magnitude, valence, who and what is affected by a hazard, are all risk themes that can be easily be calculated by science (Palenchar & Heath, 2007:121-122). From these opposing schools of thought emerge three fundamental ways in which people model, conceptualise and perceive risk (Slovic et al., 2004:1): analytically, intuitively and politically. This research therefore proposes a model that takes cognisance of the expert-lay conflicts that mar risk communication.

2.5 Proposed model (FRCM)

Hardly any frameworks or tools have been designed specifically for the field of natural hazards, rather a combination of general approaches from different domains are used (Höppner et al., 2010:28). This alternative model presents an integrated approach to risk communication and risk behaviour by consolidating existing theory, empirical findings and lay perceptions. Risk is often found in literature oriented according to particular disciplines that assume substantially different interpretive approaches (Palenchar & Heath, 2007:121-122). In anthropology, risk is a cultural phenomenon, in sociology, it is a societal phenomenon, the arts view it as an emotional concept, in economics it is a decisional phenomenon, while psychology has it laid out as a behavioural and cognitive phenomenon (Palenchar & Heath, 2007:122). In reality, however, all these microenvironments merge to form one major environment that is characterised by society, culture and individualisms, all of which are influenced by psychological and cognitive processes. In essence, all these microenvironments and sub-disciplines attenuate and reinforce each other. As opposed to nominating which discipline is superior to the other, Wachinger & Renn (2010:10) suggest that, the various disciplines are interconnected and work in hand in hand when it comes to risk perception and communication. The intellectual challenge comes in trying to understand how people conceptualise, perceive and behave in the face of not only flood risk but also risk communication information from experts. As mentioned before, communication based on an understanding of how people conceptualise and evaluate risk communication efforts is critical for translating risk management knowledge into effective risk practices necessary for value generation in flood risk mitigation.

It is quite evident that risk communication often fails because of the prescriptive nature of most communication efforts. Historically, it has been assumed that it is up to the expert to make decisions concerning risk because only they have a clear objective view of natural hazards, and it is their duty to convey this view to the public to help them behave more responsibly, (Fischhoff et al., 1982:241-242). This Flood Risk Communication Model (FRCM) stirs the debate away from this school of thought by exploring the role of knowledge evaluation and translation between the expert and the public, and by taking into account conflicts (conflicts of interest and conflicts of cognition) that arise from poor knowledge translation, and that often lead to behaviours that are termed inappropriate.

This model integrates descriptive psychological models (prospect theory and heuristics and biases) with social construction theories (social networks and trust and cultural approaches) to account for perceptions, communication conflicts and behaviours that are considered irrational in populations exposed to natural hazards such as floods. Risk perception is seen as an on-going process of collecting and interpreting varying signals about uncertain events and their impacts. It involves both direct observation in past experiences, social networks, and the risk communication itself. Risk perception will allegedly differ depending on the risk propensity of the individual, social context, environmental context surrounding the individual, the nature of the risk itself (natural or manmade), past experiences, and the quality of the risk communication and risk communicator to bring about differences in knowledge, experience, values, attitudes and feelings towards the risk. Individual risk propensities deal with a person's risk seeking or aversive behaviour (Rohrmann, 2008:5). Past experiences play a significant role in two ways: problem domain familiarity and risk history (Sitkin & Pablo, 1992:22-23). In the risk history of the individual, influences such as memory, emotions and salience of the events that occurred in the past are at the centre of how an individual responds to flood risk, whereas, in problem domain familiarity, tolerance to flooding occurs due to increased levels of events independent of the outcomes in the past. Social contexts take cognisance of available information networks. People often rely on information gathered from families, friends, the media and other social groups (Sitkin & Pablo, 1992:21), especially under conditions of uncertainty. Wachinger and Renn (2010:34) attribute social networks to issues of trust. Environmental factors are taken to include vulnerability indices, economic factors, home ownership, location, geography and status (Wachinger & Renn, 2010:34). The quality of the risk communication and the risk communicator are also influential in risk perception. The quality of the information lies in the way the way the risk communication is framed while the quality of the risk communicator can be seen in norms of the organisation (Sitkin & Pablo, 1992:19; 24). For instance, an

organisation that fosters, community empowerment will generate different behaviours from an organisation that offers aid and relief. The nature of the hazard has already been discussed under evaluative conflicts.

The ideal route is represented when the target population assimilates risk communication information from experts, processes it directly, and forms perceptions which are assumed, should lead to mitigation behaviours (attitudes, motivations, awareness, knowledge). Risk communication information typically contains attributes of a statistical nature (in terms of magnitudes and probabilities) and attributes of an uncertain/rare nature (in terms of the nature of the hazard such as climate change, floods, droughts etc.) that are difficult to conceptualise. This often leads to evaluative and cognitive conflicts between the experts and the lay. Cognitive (Knowledge based) processing represents the human mind, the so called 'intuitive statistician' as postulated by the founders of the prospect theory, Kahneman and Tversky (Heukelom, 2005). At this stage, information from the risk communication is processed by editing (including such processes as coding, combining, segregating and cancelling) and evaluated in accordance with the prospect theory. The main aim of this cognitive processing can be explained in terms of mathematical and economic psychology, whereby the intuitive statistician aims to maximise some defined criteria or utility on the basis of probabilistic information from the risk communication. At this point decision making involves a trade off of likely costs and benefits (Eiser & White, 2005:5). The final outcome or choice of action or non-action will depend on (1) the way the risk communication is framed; (2) the nature of the hazard; (3) past experiences; (4) the nature of the relationship between the communicator and the recipient and (5) the socio-economic context (risks arise not only from hazards but also from the choices and decisions we make and the consequences of those decisions (Eiser & White, 2005:5).) of the environment to result in biases that aim to maximise utility and simplify the processing stage. This is why risk communication information should ideally consist of analytic risk information inferred from the perceptions of the target population.

The sole purpose of ideally framing a risk communication lies in trying to simplify the mental task involved in cognitive processing, thereby indirectly minimising the use of simplifying heuristics that often lead to errors in judgement. If audience characteristics and perceptions are known prior to the risk communication, they can be easily factored into framing the risk communication narrative to suit that particular population, thereby decreasing judgemental errors. The nature of the hazard also plays a critical role in the way the hazard is conceptualised by the recipient. Natural hazards, as opposed to

technological hazards, are rare, involuntary, and complex and often occur with not only differing but extreme magnitudes and probabilities. Dealing with natural hazards entails dealing with unknown events, which are difficult to predict and comprehend, and therefore uncertain in every way. This model assumes there is a greater tendency for people to employ judgemental heuristics with natural hazards than technological hazards due to the uncertain nature of natural hazards. Furthermore, this nature of uncertainty leads to information seeking behaviour (Theory of uncertainty) either consciously or unconsciously from past experiences, social networks and other value systems that are all subjective in nature. According to Eiser and White's conceptualisation, as uncertainty increases, the propensity to turn to other people's judgements increases (2005:5-6). The importance of this information seeking behaviour lies in its determination of subjective value, by bringing in other value systems such as issues of trust between the recipient and the risk communication agent, as well as other contextual issues. In essence, this model is a holistic representation of how risk communications are evaluated to make decisions about natural hazards under conditions of uncertainty to ultimately influence the risk propensity of an individual. People have different values and priorities (socio-cultural), circumstances (socio-economic) and experiences (personal past experiences) that they bring to the table when evaluating risky options that often lead to biased judgements.

2.6 Theories behind the model

For a better understanding of the FRCM, its assumptions and ability to account for behavioural and decision making under risk and uncertainty, it is first essential to critique other theories and models.

2.6.1 Normative theories

Three basic theoretical approaches to decision making can be identified in literature: descriptive theories, normative theories and computational approaches (Johnson & Busemeyer, 2010:736). Normative theories use algebraic representations of ideal behavioural characteristics and mechanisms for optimal decision-making. The decision processes assume a purely analytic mathematical concept. Decision choices are reduced to random variables casting decision problems in terms of expectation in a bid to maximise expected utility among probability distributions of outcomes (Johnson & Busemeyer,

2010:736). The best course of action will therefore represent the best-expected outcome with the greatest probability of occurrence (Oliveira, 2007:13). In layman's terms, people are more likely to choose an option that will generate the greatest expected value (Morrow, 2009:22). For example: If an individual living in a substandard dwelling and in an area prone to flooding is given a choice between two options; (a) a certain move to a flood free zone with standard housing valued at \$100 000, and (b), an uncertain option with a 50% chance of nothing happening and a 50% chance of moving to a flood free zone with standard housing valued at \$250 000, the decision maker is predicted to choose option (b) because the probability multiplied by the option yields a higher expected value compared to option (a) i.e. $(0.5 \times 250) > (1 \times 100)$.

This approach has been criticised because, not only will people be unlikely to apply this analytic mathematical machinery in reality when choosing options, but it also fails to take into account people's subjective values (Johnson & Busemeyer, 2010:737). It would also be expected that an individual would forfeit paying \$1 at a lottery for a 10% chance of winning \$10 simply because the expected value is the same as the cost of the ticket, but in actual fact, someone will actually consider paying for the ticket because the loss of a dollar does not compensate for the 10% chance of winning ten dollars and 90% chance of winning nothing. In the same token, with the example of flooding given above, some individuals would also choose option (a) because it represents a sure chance of moving than option (b) which has an equal chance of either gaining property worth more than option (a) and also an equal chance of gaining nothing at all. Subjectivity can also be compared to the value of a million dollars to an individual who earns 250 dollars a month and an individual who earns 100 million dollars a month.

Rationale theories have also been highlighted as being process-centred, focusing on the process of choosing an outcome as opposed to the outcome itself (Johnson & Busemeyer, 2010:736-737). Going back to the example given above, the relevance of exploring the chosen option can provide insight into people's perceptions and values. The irrational behaviour of choosing to stay in a flood prone area could theoretically be explained by past experiences with flooding, the relationship between the choice giver/risk communicator to the decision maker, or feelings of being connected to a place (Wachinger & Renn, 2010:17). It has also been criticised for assuming that if decision makers rank one option above another, chances are that they will react the same way whenever a choice is imminent providing the same options (Oliviera, 2007:13). The rational model of decision making therefore becomes inadequate to explain flood risk perception and decision making due to: (1) Inability to account sufficiently for

choice of outcome and other irrationalities; (2) failure to account for subjectiveness and (3) inability to account for evaluative and cognitive conflicts in the risk management realm.

2.6.2 Heuristics and Biases and the prospect theory

Descriptive theories like rational theories are also algebraic in nature but have the additional advantage of incorporating known limitation of human behaviour (Johnson & Busemeyer, 2010:736). This theory tries to account for the irrationalities witnessed in rational models of decision making by attributing irrationality to cognitive psychology (Oliviera, 2007:13). They argue for the existence of filters and simplifying mechanisms in information processing and acknowledge the presence of other determinants of behaviour such as beliefs and culture. Two widely researched descriptive theories include the attribution theory and the prospect theory (Oliviera, 2007:13). The attribution theory highlights the existence of certain working hypothesis called schema that people employ when interpreting certain aspects about the environment. The schema is holistic in nature and includes aspects about oneself (self schema), other people (persona schema), groups (role schema) as well as sequences of events (scripts). The schema is prone to change with changes in information acquisition and the rate of change is directly related to the rate of acquisition of new information. Once schema is formed, it is believed, it becomes resistant to change (Oliviera, 2007:13). It is also believed that people use cognitive illusions otherwise known as heuristics to facilitate the processing of information relevant to their schema. Common heuristics that people use under conditions of uncertainty include the following:

2.6.3 Availability heuristic

People estimate frequency and probability of uncertain or rare events by the ease with which they are brought to mind, such that rare but significant events are overestimated (Taylor-Gooby, 2004:4; Taylor-Gooby & Zinn, 2005:11-13). According to Tversky and Kahneman (1974:1127) availability heuristic is a useful clue for assessing frequency and probability because instances of larger classes are remembered more clearly than smaller classes. This aspect is applicable to past experiences in the flood risk communication model. Significant but rare flooding events will most likely be overestimated because they are more memorable or retrievable as compared to insignificant, but numerous events which are

less memorable and easy to adapt to. Theoretically, flood risk communication will most likely have an impact on an individual who experienced a devastating flooding event at one point in time as compared to an individual who has had several encounters of insignificant flooding events. The same applies to an individual who has actually experienced flooding compared to one who either heard about it or read it in a newspaper. Linked to this are common aspects such as familiarity, imaginability and vividness that lead to certain biases (Tversky & Kahneman, 1974:1127-1128). Climate change is one such example affected by imaginability. Because the evidence dates back to centuries ago, the evidence is therefore not salient in the human mind and becomes difficult to conceive. It seems also, imaginability is not necessarily linked to memory, but both play a role in cognition.

2.6.4 Representative heuristic

In representativeness, judgements are made based on the degree of similarity of essential properties to parent population, a heuristic assessment of connotative distance (Shanteau, 1989:166; Taylor-Gooby & Zinn, 2005:13). With respect to natural hazards this heuristic can be tackled indirectly by assessing its mirror image. For example, it has been found that people at risk of flooding in South Africa live in substandard housing coupled with a shortage for housing in the country (City of Cape Town, 2009:26-28; Smit & Ziervogel, 2009:1-10). To solve this housing problem, the government endeavours to build houses for people and resettle them (City of Cape Town, 2009:28) at the same time. The solutions provided for flood risk management includes upgrading substandard dwellings and resettlement from flood prone areas in the long run (Smit & Ziervogel, 2009:7-8), which automatically involves building houses for people. One cannot help but notice the similarities in the solutions provided for the two different problems. The same applies when the country tries to tackle health problems by providing water and sanitation that involves upgrading substandard dwellings and providing piping infrastructure. It seems that instead of empowering residents and capacitating them to adapt to flooding, governing institutions provide the same solutions to solve different problems. Therefore, the crux of the matter is, people in flood prone areas use representative heuristics to tackle health, flooding and housing problems. Residents simply expect to be have the government build new houses instead of adopting adaptation measures from risk communication such as raising floor levels of dwellings, using sandbags and digging trenches to aid running water. Other important representative heuristics identified by Tversky and Kahneman (1974:1124-1127) include misconception chance and insensitivity to prediction.

People are said to judge chance as a self correcting process such that if a risk communication is presented with a particular probability of occurrence, say 50% this year, because chance is self correcting, perhaps next time or next season there is also an equal chance that it will not flood thus disregarding the point that it could flood continuously for the next decade and with increasing magnitude. On insensitivity to judgement the degree to which the description is favourable does not become affected by the extent of reliability of that description. When information is obtained from social networks it will be judged to be either favourable or unfavourable disregarding the reliability or accuracy of that information and will impact on predictability accordingly. This unwarranted confidence is called an illusion of validity (Tversky & Kahneman, 1974:1126).

2.6.5 Anchoring and adjustment

Anchoring and adjustment is related to loss aversion. First, the judgments are anchored on an initial value generated by some form of incomplete computation, then adjusted to present circumstances following which a loss tends to be weighted higher than a gain at an equivalent point (Taylor-Gooby & Zinn, 2005:13; Taylor-Gooby, 2004:4). The initial value therefore is biased towards the initial point (Kahneman & Tversky, 1974:1128).

Although these heuristics and biases have more than proved their worth in explaining the decisions that people make when faced with natural hazards, they have had their fair share of criticism. Shanteau, (1989:167) summarises some of them: (1) a lot of empirical evidence is framed in the negative (cognitive biases and judgemental errors) and insufficient effort is given to reflections of appropriate behaviour, which makes it difficult to standardise what falls under the category of 'appropriate behaviour'; (2) literature also has it that some of the heuristics are overstated such as the heuristic of representativeness where empirical evidence from the past in relation to other factors points out the ability of human beings to figure out more than what they have been given credit for; (3) the theory does not stipulate conditions under which people do and do not perform well; (4) there is lack of sufficient room to place feedback mechanisms between the organism and the environment (Shanteau, 1989:167) and (5) no hierarchical representation of the cognitive illusions has surfaced so who is to explain which illusion takes more precedence than the other.

2.6.6 Prospect theory

In the prospect theory, Kahneman and Tversky, combine the rational man from the normative theories of Expected Utility Theory and Subjective Expected Utility (EUT and SEU respectively), and the intuitive statistician from the descriptive theory (heuristics and biases), to represent a man who is prone to evaluating decisions based on expected gains and losses while at the same time, he is prone to misjudge due to intuition (Heuvelom, 2005:9). The prospect theory addresses the mode of action of how choices which promote contradictory values and goals are evaluated in the decision making process (Oliviera, 2007:14). The theory explains the underlying mechanisms of how judgemental heuristics come about so that in actual fact, the latter represent effects of the aforementioned (Heuvelom, 2005:17). It introduces important aspects such as pre-decisional editing, loss aversion, reference dependence and decision weighting borrowed from cognitive psychology, making it more human centered (Johnson & Busemeyer, 2010:739) and applicable to important decisions such as life and death.

Editing or framing is the first phase of the prospect theory. In this phase, all the opportunities, predicaments, outcomes and acts associated with a particular choice problem are prepared, simplified and inferior choices are eliminated (Johnson & Busemeyer, 2010:739). Therefore, we deduce that a recipient's choice is influenced by the way the risk communication is presented and communicated. This is the most critical chapter as the recipient does not know the number of choices available to him/her and has to cipher this from the risk communication. We adapt the following example from McDermott (1998:21) and put it in terms of flood risk:

Two flood risk communication programs are implemented in two different designated 'high' flood risk zones with estimated populations of 900 residents. Program (a) carries a message that an estimated 300 residents will be killed if no flood risk reduction measures are taken such as the use of sandbags to elevate homes, and program (b) carries a message that there is a one third chance that 900 residents will be saved and a two third chance that no one will be saved if flood risk reduction measures are not taken such as the use of sandbags to elevate homes. Which program will carry a high response rate (as measured by the number of people using sandbags to reduce flood damages)?

Computing the expected values of (a) and (b) gives us similar net outcomes. But studies have shown that probabilities of choice will be highly polarised, with the majority of the respondents being motivated

towards program (a) because of the way it is framed (McDermott, 1998:21). Most decision makers remain unaware of framing effects and resort to intuitive assessments. Sitkin and Pablo (1992:20) highlight that, "By stressing the potential losses implied by a decision, the salience of risk is heightened." Situational framing becomes influential in determining the risk perception of the decision maker. All risk communication effort should be adequately aware of these framing effects.

Adapting the same example further from McDermott, (1998:21):

Program (a) carries a message that an estimated 300 residents will be killed if no flood risk reduction measures are taken such as the use of sandbags to elevate homes, and program (b) carries a message that a lot of people will be affected if no flood risk reduction measures are taken such as the use of sandbags. There is a greater probability that program (a) will have a greater impact i.e. the level of acceptance will be higher for (a) than (b) simply because there is a greater level of qualification. This phenomenon is called acceptance and segregation and is an important part of the editing process (Kahneman & Tversky, 1979:274). Acceptance argues that if an option is reasonably constructed, the decision maker is unlikely to recast, reformulate, question or second-guess it as opposed to if the option is inappropriately formulated or framed. Segregation is best conceptualised by the idea that people tend not to adequately take account of other related issues, (as opposed to the implications of the normative model) but only focus on the issues at hand that are considered most relevant to the immediate problem, in other words, priorities take shape.

Other factors that are known to influence framing are the norms, habits and expectations of the decision maker, (Tversky & Kahneman, 1986:S257). This further stresses the concept of knowing your audience before commencing any risk communication. Whereas these norms and habits are prone to cognitive biases and are idiosyncratic to that decision maker, decisions based on the way the option is framed can be described systematically (Tversky & Kahneman, 1986:S257). Coding is one such idiosyncratic way of editing options with such cognitive biases. A risk communication program that stipulates that the greatest number of deaths and damage to property due to flooding is most likely to be experienced this year as compared to all the other years in a particular area is most likely to instigate a lot of responses even without specifying the numbers of deaths and damages incurred in previous years. Therefore, people categorise outcomes in terms of gains and losses rather than in terms of absolute wealth because they are averse to losses (Kahneman & Tversky, 1979:274). The amount of wealth or belongings that you have at that point serves as a reference point disregarding its worth such

that, a person who owns 200 dollars worth of property will be just as averse to losing it as much as a person who owns a million dollars worth of property.

People also have a tendency to add together probabilities with similar outcomes, an editing notion referred to as combination editing (Kahneman & Tversky, 1979:274). For example, an individual living in a part of town with a 20% chance of dying due to harsh storms, and another 20% chance of dying due to a fire will likely consider relocating to an area with a 20% chance of dying due to flooding assuming a 40% chance of dying due to a fire or a storm.

Cancellations, simplification and detection of dominance are also part of the editing process (Kahneman & Tversky, 1979:274-275). In cancellations, decision makers show tendencies towards discounting options that appear across all choice sets such that if an option appears to be the same in all choices provided, it ceases to be significant. This can be likened to a scientific experiment whereby, if a condition is the same in both the control and the experimental group, it ceases to be an influencing factor. Cancellation is said to be critical because it accounts for maximisation of utility and is the root of many economic decisions (Kahneman & Tversky, 1986:S252). Simplification involves discounting unlikely alternatives or anything that resides out of the familiarity zone, as well as rounding off probabilities especially in computing figures. Simplification is more like a mathematical formula for eliminating what is reckoned to be unlikely and for adding or subtracting the significance of a value.

It is quite evident that these editing and framing operations are essential to risk communication and the cognitive processing of information influential in risk perception (Sitkin & Pablo, 1992:20). However more attention needs to be given to other aspects such as the sequencing of these operations. It has already been assumed that these processes are automatically occurring but some operations will sometimes take precedence over others, such as in cancellation and detection of dominance, but still, no research has pointed out any form of sequencing (Kahneman & Tversky, 1979:275). The choice between taking and not taking preventive measures against floods can be manipulated through framing without necessarily changing the substantive content of the risk communication. Even those individuals who have very strong preferences in terms of outcome might have different preferences in a different framing of the same problem. The flood risk communication model argues that manipulating the different aspects of the prospect theory processes through risk communication can have a direct influence on the heuristics and biases that the audience makes, and therefore, can be used to alter their

perceptions in making flood risk judgements. However, this is only applicable if the audience characteristics are factored into the communication so that errors can be reduced on the part of the communicator (note: this research would rather refer to risk communication conflicts as errors on the part of the communicator and as biases on the part of the audience).

The second evaluation phase of the prospect theory consists of value and weighting functions and is very significant towards the perception of risk (Kahneman & Tversky, 1979:277-281). Firstly, it is defined in terms of gains and losses relative to the reference point. This is in keeping with basic human perceptual processes that tend to notice shifts in states as opposed to resting states such that, an individual is prone to noticing relative states of for example, sound, temperature and brightness (Kahneman & Tversky, 1979:277). A person is most likely to notice the change in volume of a stereo that is playing than the fact that the stereo has been playing at a constant sound for a period of time; this is the same as when one notices a person who is shouting as opposed to people that are in constant chatter. In monetary terms, gaining a 100 dollars increase in salary would mean more or would be more significant to a person who earns 200 dollars a month than a person who earns 20 thousand dollars a month. There are two important points to note, firstly, the asset position serves as a reference point and secondly, the risk propensity is also a function of the magnitude of the change. The second principle of the evaluation phase is that people tend to be risk averse in the domain of gains and risk seeking in the domain of losses (Kahneman & Tversky, 1979), which is the essential feature of the theory. Notice how this also relates to risk propensity. In our current South African context, people leave rural areas to urban areas seeking for better opportunities. Therefore, they tend to settle in informal settlements where flood risk is high, but because they are currently in the domain of loss, they become ignorant to risk factors affecting those areas such as flooding. Thirdly, losses hurt more than a comparable gain (Kahneman & Tversky, 1986:258). Individuals tend to get comfortable at a particular status quo such that one would rather stay and protect their property in the imminent threat of a flood than leave their belongings and start afresh at a different location. People are averse to losing any component part of their wealth.

Dwelling deeper into the second phase of evaluation consists of giving each outcome a decision weight. The value of each outcome is multiplied by the decision weight, of which the latter is empirically derived from assessments of likelihood (Kahneman & Tversky, 1979:280). Events that are judged to be either certain or impossible are given heavier psychological weights than other events (Kahneman & Tversky,

1979:283). This pinpoints peoples' limitations and biases towards unimaginable and incomprehensible events. At the same time, events that are judged to be more likely are under weighted and those that are less likely are over weighted (Kahneman & Tversky, 1979:283). A good example would be, if flooding occurs each year, it has a lower impact psychologically and people will tend to consider risk combination messages pertaining to such events as unimportant. In other words, people become tolerant to likely events than to unlikely events. They also become tolerant to low magnitude events than to high magnitude events.

2.6.7 Trust theories and the affect heuristic

Descriptive models have evolved with time and started to include additional considerations beyond expected utility. This includes aspects such as satisfaction; disappointment and fulfilment of certain goals (regret theory) bringing into focus the role of emotions (sometimes referred to as affect) (Johnson & Busemeyer, 2010:741) and the advent of the two-way system in decision theories (Slovic, Finucane, Peter & McGregor 2004: 1). According to Finucane, Alhakami, Slovic and Johnson (2000) the role of affect in decision making is riddled with controversy, such that some state of the art reviews refuse to even mention the word and the role it plays in decision making and perceptions. One such author is Sjöberg (2006:101) in 'Will the real meaning of affect please stand up?' He argues that empirical evidence of such a relationship is very weak if a direct or literal translation of the word is adhered to. Contrary to this observation is the work by Shafir, Simonson and Tversky (1993:30-34) who attest that occasionally people's choices stem from affective judgments that preclude a thorough evaluation of the options. Zajonc (1980:153-154) is also a strong supporter of the theory and argues that no perception is affect free either in verbal or in non-verbal cues, in fact people use affective judgements all the time such that an adjective is always placed before describing an object. One does not just see a house but sees an ugly/beautiful house, and one does not merely decide in favour of an option, but actually goes for the option he/she 'likes'. Affect is also demonstrated by Damasio's work (1994) which posits that, thought is largely made up of images which include perceptual and symbolic representations marked by either negative or positive markers, directly or indirectly related to bodily states. These somatic markers increase the efficiency of decision making by sounding an alarm if a negative somatic maker is linked to a future outcome, and the opposite is true. Some other theorists like Slovic et al. (2004) associate affect to the experiential system as supported by Zajonc (1980:154) who postulated that affective reactions to

stimuli occur automatically and guide information processing and judgement. The existence of affect therefore cannot be denied, even though the operational facets are still in question. Of note is its association with words such as fear, satisfaction, motivation, like, dislike and pleasure (Zajonc, 1980:154).

In flood risk communication affective responses are brought about in two ways: firstly, in terms of trust issues between the risk communicator and the recipient based on past relationships and, secondly, in terms of past experiences with the hazard itself as determined by gains or losses in the past. Finucane et al. (2000) proposes that people use an affect heuristic to make judgements such that images of objects and events in people's minds are tagged affectively at varying degrees. Furthermore, Finucane asserts to the existence of a relationship between risks and benefits using affect, such that people may judge the risks and benefits of hazards by accessing positive and negative feelings associated with the hazard. For example, if a person lives in a flood prone area and loses a lot of property in the previous flood, he becomes risk averse, and a risk communication message is more likely to stimulate negative feelings against flooding hazards. Therefore, this individual is likely to implement flood prevention measures as opposed to a person who did not experience any losses. Also related to the affect heuristic is the influence of memory on affect, which relate to the availability heuristic mechanisms of imaginability and vividness. Using computational models, Fox and Cooper (1997) assess how decisions are made under the influence of memory. The study concluded that knowledge which came to mind easily will have greater influence on decision making compared to knowledge which is retrieved slowly. If this is the case, then it stands to reason that this readily available memory is both symbolic and part of the experiential system in decision-making. This is synonymous with children when they first learn about fire; they touch it once and will never touch it again simply because it is stored in their intuitive memory compared to mathematical problems learned at school that take time to be retrieved. This same concept applies to highly significant events in a person's life. Inferential decisions can be made by recognition memory, when the likelihood of recognition based on salience is correlated with the decision criterion (Johnson & Busemeyer, 2010:745). If an event or hazard is associated with more than average negative or positive makers in past experience, it becomes experiential memory and readily available to influence intuitive decision-making (Finucane et al., 2000). Thus decision-making becomes a process of applying specialised and general symbolic knowledge to symbolic data (Fox & Cooper, 1997).

As postulated by Zajonc (1980), affect dominates social interaction as people evaluate each other all the time for possible motive and consequence of behaviour. In accordance with this assumption, Calnan and Rowe (2005:2) also write that, trust consists of both cognitive elements (rationale and instrumental judgements) and affective components brought about by the development of interactive and identification bonds. Therefore, trust comes across as a multi-layered concept, which grows in an environment where there is uncertainty and risk (Calnan & Rowe, 2005:2). According to Eiser and White (2005:4-5) when uncertainty increases, it is not only just anyone's opinion we seek, but also someone whom we believe to have better knowledge than us and is motivated to tell us what they believe about the risk. Thus, risk perception becomes based on social judgement and how trustworthy the risk communicator is to us. When trust is misplaced or non-existent, the value of the expected outcome will be significantly lowered (Twyman, Harvey & Harries, 2008). Thus, trust in risk management is negatively related to risk perception.

Trust can be defined as some form of willingness, in expectation of beneficial outcomes, to make oneself vulnerable to another based on a judgement of similarity of intentions or values (Twyman et al., 2008:111). Trust measures two things, an advisors' competence reflected as confidence; and trust in motives as measured by sharing similar values usually coloured by integrity and honesty (Twyman et al., 2008:111). There are various models that have been postulated to explain the role of trust in risk communication. One such theory is the one discussed above by Zajonc where trust is related to both cognitive and affective processing of information. McAllister (1995) used this dichotomy to explain the dual process of trust where cognition was related to information such as knowledge, competence, reliability and dependability while the affective component consists of emotional bonds riddled with care, concern, virtues and other sentiments. However, this approach has been found to be more suitable in particular settings but not all, for instance for emotional bonds to grow, there should be some sort of persistent interaction, making this theory difficult to apply to risk communication. An alternative dichotomy is that of Siegrist, Gutscher and Earle (2005) who postulated that, what is viewed as affect based is actually trust in the motives of the communicator, and what relates to competence is actually confidence in the source. In this theory, the level of trust will be highly dependent on the number of shared values. Certain similarities can however be found between McAllister and Siegrist's models, for one, shared values include aspects such as similarity of goals, which can evoke feelings such as empathy. Both models therefore share the role of affect in trust. In context of the flood risk communication model, trust in the risk communication will depend on the values as reflected in the risk

communication narrative, while trust in competence will be defined by the review of past interactions with that risk communicator including references pertaining to that agency from other social networks. If the levels of trust are high, there will be a resultant influence on the recipient's risk perception and ultimately cooperative behaviour.

Another important characteristic to note from Siegrist et al. (2005)'s trust confidence and cooperation (TCC) model is the influence of social filters and social values. If one's social networks judge a risk communication source to be trustworthy, it influences individual assessment of the source, such that an individual will still view poor performance by the source charitably. Social desirability will outweigh intellectual desirability. Social desirability is embedded in culture, while culture is the root of preferences as evidenced through behaviours and beliefs (Oliviera, 2007:14). Natural hazards such as floods and earthquakes, although they can influence behaviour, they will always be assimilated first into social structures of understanding. Cultural theory posits that individual views are influenced by the nature of the social groups they belong to (Tansey & O'Riordan, 1999:72). This is in line with the social identity theory where group membership is said to play an important role in behavioural mechanisms. Cultural theory examines how risks are constructed socially through value identification and trust building (Tansey & O'Riordan, 1999:72). Risk is therefore in part, a social phenomenon that cannot be studied in isolation. This explains why one technology is feared in some societies and not in others (Oltedal, Moen, Klempe & Rundmo, 2004:18). Indeed it can be argued that humans are social beings and it is only natural to study them in their social contexts.

Risk is all about thoughts, constructs and belief and these aspects can have a profound influence on how it is perceived (Oltedal et al., 2004:11-12). Risk perception is therefore in part due to cultural adherence and social learning. In this context, culture also results in cognitive biases due to shared beliefs and values. Cultural theory explains how people perceive risk according to their particular way of life as cultivated in generation after generation (Oltedal et al., 2004:17). Views, opinions and empirical evidence about the influence of culture on risk perception differ widely. Mainly criticism stems from the fact that the theory presupposes a correspondence between a person's way of life and a person's individual orientation (Oltedal et al., 2004). It therefore implies personality as an explanatory concept despite abstinence from using the word. However, its descriptive power in explaining tendencies and dispositions cannot be over looked, nor can the influence of values and interests (guided by social norms) be ignored (Wachinger & Renn, 2010:32). Certainly, the social amplification of risks and the

influence of impersonal social networks need some consideration in this regard. Personal values and beliefs can also be considered in relation to culture.

2.7 Methodology

This research employs the associative group analysis (AGA) technique as a cognitive mapping approach to elicit mental models and risk perceptions of people living in areas designated as high flood risk informal settlements. The cognitive mapping approach uses concepts to express an idea and links it to other related issues (Brightman, 2003). The basic assumption is that, information is selected for attention and processed according to pre-existing knowledge structures called mental models. Ideally, the technique allows reconstruction of perceptions and evaluations from puzzle pieces of subjective images and meanings obtained empirically from spontaneous free associations (Szalay, Bovasso, Vilov & Williams, 1992). Lorand Szalay developed the method specifically for assessing psychological dispositions such as perceptions, attitudes and beliefs (Grenard, 2003). So far it has proven useful in studies pertaining to cultural perceptions and also in drug use behavioural studies (Szalay, Canino & Vilov, 1993). The cognitive mapping approach developed primarily by Colin Eden (Brightman, 2003) is based on the assumption from behavioural theorists and scientist that behaviour is guided by cognitive maps, and represent how people conceive their environment (Szalay et al., 1992). AGA uses free word associations to elicit subjective representations as opposed to beliefs and opinions that are based on emotional and rational responses. Furthermore, it reduces bias as compared to asking questions whereby the way the question is phrased can affect the wisdom of the response (Fischhoff et al., 1982:243). Essentially, respondents are asked to write down free word associations based upon a particular stimulus word relevant to the field of study. Szalay (1992) goes on to assert that these free associations hold psychological dispositions, which are in turn laden with personal experiences, affective feelings and perceptions. This research therefore argues that, the associations obtained will be a reflection of the relative values people place on the various aspects relating to flood risk and flood risk communication. It also seeks to argue that aspects that are not represented in the responses do not bear any relevance to the respondents because (1) they are 'rejected' as explained by the prospect theory; (2) they are not properly represented in the risk communication and (3) those aspects that are well represented reflect the respondents' priorities. The data obtained will be compared and contrasted with the proposed model.

In line with semantic differentiation, the content of the responses to stimulus words will be further analysed to discern people's feelings towards risk communication and risk communicators themselves in a bid to evaluate the effectiveness of the current risk communication efforts.

2.8 Implications of the research

From the above debate, we notice that theorists are basically trying to distinguish between two systems of cognition, the analytic system as used by experts and as seen in rational decision making, and the more intuitive system which is prone to cognitive illusions and hence irrational decisions (Kahneman, 2003; Slovic et al., 2004). Furthermore, there is a feedback mechanism between the environment (socio-economic) and the individual concerned that account for irrationalities such as beliefs and values solely constructed by the individual concerned. At the core of this research is the hypothesis that differences in perceptions and preferences form the basis of many conflicts and communication failures, an assumption that Weber and Hsee, (1998:1205) seem to agree with. Although it can be argued that, risk perceptions and attitudes are only possible but not actual determinants of behaviour (Rohrmann, 2008:3), Weber and Hsee (1998:1206-1207) argue that; (a) if differences in risk perception are at the core of risk propensities, then a mutual exploration of possible differences should focus on cognitive and perceptual variables and, (b) if it concerns perceived risk attitudes, then the focus should be on affective responses. Clearly, the flood risk communication model has taken into consideration all aspects relating to risk perceptions and risk attitudes by incorporating both affective and cognitive responses to natural hazards. Although, the psychometric paradigm is often used in measuring affective responses and attitudes towards particular risks, it becomes rather limited in exploring the intuitive system. According to Sjöberg (2006:3) the psychometric paradigm leaves some of the variances of perceived risk and attitudes unexplained. Features of the intuitive system, (effortless, associative, implicit and affective according to Kahneman (2003:1450-1452) and Slovic et al. (2004)) have been found to be greatly related to perceptual characteristics of a person, making them more stimuli bound, thus making the AGA the more appropriate method of exploration. Although the concept of affect is controversial, literature seems to agree that intuition contains some form of affect, in the psychometric paradigm it's related to dread and fear of certain technologies (Fischhoff, Slovic, Lichtenstein, Read & Combs, 1978), in the cultural theory, it is related to trust issues and in science it is related to intuition and our evolutionary history. Zajonc (1980:154) writes: "What I want to argue is that the form of experience that we came to

call feeling accompanies all cognitions, that it arises early in the process of registration and retrieval, albeit weakly and vaguely, and that it derives from a parallel, separate and partly independent system in the organism.” According to Kahneman (2003:1451), in order to understand intuition, one must be able to explain why some thoughts come to mind more easily than others. This is in support of the AGA and the FRCM. Our proposed flood risk communication model tries to account for this ease of accessibility in terms of past experience, salience, emotions and imaginability and explains how these lead to biases in flood risk perceptions and management by integrating most of the decision making models, from economics to psychology.

The analytic system on the other hand uses algorithms and normative rules in decision-making and is the evolution of most risk communication conflicts. It is important to note however, that the two systems are not mutually exclusive but rather act in conjunction (Slovic et al., 2004:1-2). Intuitive judgements form a buffer between concepts and percept or between logical analysis and perceptual impressions. It therefore follows that, in this buffer zone lies the route of common sense reasoning. Conclusively therefore, heuristics operate in this buffer zone to form impressions of a risk from analytic risk communication. And because this zone contains some form of percept, it is sensitive to stimulations such as framing. Conscious awareness of heuristics can therefore help an individual to improve the intuitive system by applying heuristics to more appropriate situations. Dissemination of risk information structured appropriately and taking into cognisance other values and beliefs can improve logical reasoning and inferential statistics on the part of the recipient and at the same time solve risk communication conflicts.

CHAPTER THREE

3.1 Introduction

As established in the previous chapter, the main objectives of this research are to develop a model that explains how people living in informal settlements designated as 'high' flood risk evaluate and react to risk communication, and also to explore the extent to which the model succeeds in reflecting lay evaluations. Thus the FRCM was introduced. This chapter aims to review all the possible theories upon which risk communication models are formed. It begins by exploring the various approaches and backgrounds to risk communication, then followed by a discussion of the current epistemological background currently being utilised in South Africa.

3.2 Main approaches to risk communication

Three main sub-disciplines have been nominated as the major contributors to risk communication: cognitive psychological theories, communication theories and risk assessment (Grabill & Simmons, 1998:417). However, the link between these disciplines and the emergence of risk communication cannot be fully grasped without an understanding of the plethora of issues that govern the discord between science experts and the general public on risk issues (Plough & Krinsky, 1987:4). Five types of conflicts in risk communication have already been identified: evaluative conflicts; cognitive; interest; procedural and value conflicts, the most profound being cognitive conflicts. According to Grabill and Simmons (1998:417-418), the most dominant contributions to risk communication were risk assessments. Risks to human health and the environment were identified through epidemiological, toxicological and environmental research, then quantified to determine probabilities; regulatory agencies evaluated remediation issues and the most favourable option was put into practice through standards and policies, and yet without the involvement of the public's perception of risk in the process. This led to the so-called expert versus lay debate as well as other conflicts. The response was to design models in order to effectively and efficiently explaining the concept of risk to the public, and thus giving birth to the risk communication discipline. Models ranged from communication models, psychological models and risk assessment models. Public outcry can be argued, emerged due to interest conflicts as issues of judgements of facts and judgements of value arose. For experts it concerned costs and benefits

associated with choosing a particular management option. For the public, the conflict was deeply rooted in costs and benefits associated with value systems, culture and beliefs (Renn, 2008:84-85). Evaluative conflicts also played a profound role as information was conveyed in probabilities and scientific terms. Experts therefore argued as to the best ways in which the information could be conveyed to the public to make them better understand. Communication models thus emerged as ways of finding the most probable means of conveying information about risks to the public simply because risk is determined by experts, and communication is the transfer of information from producers to consumers. Eventually, through risk research, it was realised that public outcries are due to the differences in perception of risk between the lay and the expert. Institutions thus began the construction of psychological models to explain the discrepancies between perceptions and eventually 'bring public perception into conformity with scientific rationale'. Such models include the psychometric paradigm, which will be explored in the upcoming sections.

Having briefly discussed the three most dominant approaches used in risk communication to date, it is imminent to bring forth a young but newly emerging approach to the issue, that is, the social construction of risk. Proponents for the social construction of risk argue that the current approaches to risk communication focus primarily on the risk itself while ignoring the public and other important contextual issues. Grabill and Simmons (1998:420) go on to argue that social factors play a significant role in risk perception and should be included in the decision making process. In addition to risk assessment (scientific) and psychology (behaviour), this brings in a whole barrage of other disciplines including the role of culture (anthropology), societal phenomenon (sociology) and last but not least the decision-making phenomena (economics) into the risk communication process. However, little is known about how these disciplines contribute to the perception of the risk itself, and therefore, very few studies have focused on how public perceptions in terms of values, emotions and rationalities can be incorporated into decision making about risks and how this influences the communication of the risk. To severe the argument is to say, the physical and environmental dimensions of risk communication have been well explored; the psychological dimensions of risk communication have also been well explored; the economic dimensions of risk have been well explored (but minimally applied to risk communication), but the social dimensions of risk communication have not been explored at all. Risk communication can therefore be said to have four pillars: environmental and physical, economic, psychological and social.

3.3 Models of risk assessment and risk communication

It is important to stress the difficulty is separating risk assessment from risk communication mainly because risk assessment is the scientifically acknowledged way of perceiving risk according to expert opinion, and therefore has been fostered into our current ways of risk management. Managing societal risk entails communicating that risk to the public. When evaluating risk communication therefore, one cannot run away from risk assessments. Risk assessments form the basis of our risk communication continuum. On one end of the continuum, are the technocrats (Ziervogel & Smit, 2009:3; Plough & Krinsky, 1987:5) who employ risk assessments and believe in the one-way flow of information. It strives to sway public opinion to perceive risk in technical terms. In the technocratic approach, there is absenteeism of values, concerns, opinions and fears of the local communities; rather, the emphasis is on technical aspects. On the other end of the continuum, are the negotiated approaches, which merely represent critiques of the technocratic approach. Here, an attempt is made to incorporate other filters of information such as the role of culture. The technocratic approach is criticised as being an attempt to understand both the point and degree of deviation from technical rationality and emphasises risk communication as being independent of context. This now brings in the two-way approach to risk communication, as an interactive process between or amongst individuals and groups to reach a consensus.

It is important to mention that an array of approaches to risk communication has materialised and each stem from different backgrounds representing different aspects of the communication (Höppner et al. 2010:22), and lie at different points along the continuum. Höppner et al. summarises some of these approaches:

3.3.1 Communication process approach

Proponents of this model are interested in the sender, receiver and message relationship (Höppner et al, 2010) as proposed by Shannon and Weaver's mathematical theory of communication. It spawns terms such as information loss, source credibility and feedback mechanisms (Griffin, 2013). Proponents of this theory are interested in the relationship between the sender, the message and the receiver, the so-called linear model of information theory. Communication can therefore, not depart from these three

components of communication. The most important aspect according to the theory is the reduction of uncertainty. Weaver emphasises that semantic aspects of communication are irrelevant and communication should merely reduce uncertainty. It offers technical solutions to social problems. This theory has been criticised mainly because it represents communication as a one-way flow of information. All the other theories of communication that followed set to correct this limitation in the Shannon and Weaver model. Psychologist such as Janet Beavin Bevalas even sought further as to question whether the only goal of communication should be the reduction of uncertainty alone (Griffin, 2013).

3.3.2 Mental model approach

This is a cognitive psychology inspired model. It focuses on the audience's characteristics, beliefs and needs. The main highlight of this concept is the difference between lay and expert opinions (OECD, 2004). Atman et al, (1994) and Bostrom et al, (1994) substantiate this model. According to Jones et al, (2011) mental models are cognitive representations of reality. The concept was originally postulated by Kenneth Craik in 1943 and proposes that people carry mental representations of how the world works. These models are employed to reason, anticipate and form explanations. The models are dynamic in three basic ways (Jones et al, 2011):

- Reasoning – it is a computational structure that allows an individual to explore options before taking action.
- Causal – it has the capacity to perceive and represent cause effect dynamics of phenomena.
- Learning – it changes over time through experience and therefore has the ability to learn.

Psychologists believe that because mental models are analogue in nature and also because of the limitations of a human being's cognition, mental models are simplified versions of reality and only represent aspects driven by an individual's goals, motivations and background, including mental models existing in long term memory. Mental models therefore play a role in filtering information that fits current understanding. Incoming information may be reinforced or rejected. Atman et al, (1994:779) caution that whatever the goals of a communication, communicators need to address mental models that recipients bring to it, including knowledge gaps which can frustrate learning. This approach has

been criticised mainly because according to Höppner et al, (2010:23) it does not bridge the dichotomy between lay and expert but rather entails that there is a lay deficit that needs to be remedied.

3.3.3 Culture and ethnicity approach

Proponents of this approach argue that risk communication needs to acknowledge the ethnic subcultures in affected communities. Differences in income, education, housing quality and access to resources can impact on communication effectiveness (Höppner et al, 2010).

3.3.4 Crisis communication approach

The definitions of risk and crisis are strongly linked. Risk is an occurrence that can have positive or negative consequences of varying magnitudes. Risks that are manifested with negative consequences and at high magnitudes become a crisis (Seeger, 2006:233). The challenge in risk communication comes with the differing views of the term risk. This leads to a dissensus type crises made up of conflict brought about by differing types of values, viewpoints and priorities (Benson & Gresham, 2007:245). Whereas risk communication seeks to help people make informed decisions about particular risks, crisis communication seeks to manage the impact and public perceptions of a crisis. In essence, crisis communication is deeply rooted in emergency management and disaster management. It is associated with the coordination of resources such as equipment, personnel and information to avoid and reduce harm during and after a crisis has been realised. Thus, a one-way model of communication is adopted and theories of persuasion become essential (Höppner et al, 2010). A number of models have been postulated to aid understanding of crises communication including hazard plus outrage theory, mental noise model, negative dominance model and trust determination model (Ferrante, 2010:38-40). The mental noise model postulates that as a threat arises, the ability of an individual to process information declines. Mental noise blocks hearing and willingness to accept and process information. In the negative dominance model, people trust bad news compared to good news. This is in accordance with the Kahneman and Tversky who postulated that people place more value on the losses than on corresponding gains. Trust and hazard plus outrage will be described in the following sections. Crises

communications entails tailoring messages to better control or manage people's responses during times of imminent threat.

3.3.5 Hazard plus outrage approach

This approach is also founded on the cognitive debate of lay versus expert. In addition, Sandman nominates two variables that are inversely related to each other, 'hazard' and 'outrage'. He proposes that the experts view risk as probabilities while the lay view risk as outrage. People are therefore said to overestimate risk when outrage is high and the opposite is true. Outrage refers to the emotions and behaviours of receivers given their perceptions of the hazard and the manner in which it is framed (Ferrante, 2010:40). Both hazard and outrage are said to exist on a continuum from high to low leading to four kinds of risk communication: high hazard/low outrage, high hazard/high outrage, low hazard/high outrage and medium hazard/medium outrage. Risk communication therefore should be tailor made to manage outrage in order to manage perceptions (Schmid, 2001). Sandman goes on to suggest the best risk communication measures for the different types of emotions.

3.3.6 Social network contagion approach

Social contagion is a subset of contagion that includes all social phenomena that can spread via social networks including opinions (Barash, 2011). Influence is the most studied mechanism associated with social contagion. It stems from culture and is normally represented through a set of traits including language, religion etc. In the context of social contagion, influence implies that if one or more people embraces a belief or adopts a certain way of doing things, it has a profound influence on the peers because of the social phenomena of ego. Influence has been strongly attributed for the spread of social norms. In risk communication, social contagion proponents believe social influence perpetuates the spread of knowledge, diffusions of innovation and the establishments of technical standards. It is triggered by other mechanisms such as social identity that in turn can be linked to trust theories. Another mechanism relates to local information. Local information does not affect the likelihood of infection but rather affects exposure (Barash, 2011). This can be explained as a deviation from rational behaviour. An individual's decision is affected by the actions of his neighbours rather than the number

of adopters in general. This is such that, an individual will adopt flood risk behaviour based on how many of his/her neighbours and friends have adopted the same information as opposed to the statistics of the number of people in the country who have adopted the same behaviour. This is a deviation from rational behaviour.

Teo and Loosemore (2006:320), use the social contagion theory to investigate how perceptions of environmental risks are shaped and spread through communities. They concluded that in construction projects community members are more likely to join a protest movement and stay involved if they are connected with like-minded people in their network through cohesion and structural equivalence. In the former, frequency of communication is advocated for while in the later, members with similar communication methods influence each other. This has implications in the spread of flood risk information at community level. Proponents of this theory advocate for risk communicators to work through social networks as opposed to individuals because people rely more on the advice and opinions of people surrounding them, especially people they socialise with (Höppner et al, 2010).

3.3.7 Convergence communication approach

The convergence theory states that, the more two people or groups of people communicate with each other, the more similar their worldviews become. The phenomenon is identifiable to the social contagion approach but differs in some aspects. Unrestricted flow of information within the boundaries of a relatively closed communication system leads to convergence of beliefs, values and behaviour with a tendency towards uniformity. People are more likely to espouse attitudes values and beliefs similar to the people they have close ties with (Erickson, 1988:115). Dense networks are more likely to converge than sparse networks. The concept can be idealised by a set of points such that the closer they are the more they become one. Therefore, in a converging system, the between-persons-variance declines through communication. In risk management, risk communication becomes a process of converging values and beliefs through long lasting dialogue with lay persons (Höppner et al, 2010).

3.3.8 Social constructionist approach

This theory embodies the two basic and most fundamental debates in risk communication and perception; the first body of thought views risk as a physical attribute made up of facts which can be explained, predicted and controlled scientifically. The second body of thought views risk as a socially constructed attribute rather than as a physical entity independent from the influence of the social world (Bradbury, 1989:381). Risk communication and other responses to risk is therefore tailor made to match the school of thought from which it originates. Risk communications from the scientific school of thought advocates for technical solutions and employ psychometric approaches in order to rectify the lay deficit in scientific responses to risk. The risk communication is therefore educational and informative. The alternative approach, which addresses the value-laden nature of risks leads to management and communication processes which strongly differ from the technocratic approach (Bradbury, 1989:389). The discussion moves from mere probabilities to lay perceptions, social institutions and the socio-cultural environment in which risks can be communicated and managed. Cultural theories can be strongly linked to this approach. Solutions to risk communication in this concept are centred on structuring dialogue among different perspectives of cultural groups. Risk communication is seen as convergence process of knowledge sharing amongst participants with differing views. Knowledge and communication are rather two-way than one-way processes. Thus the constructionist approach uses contextual dialogic models of communication while the technocratic approach uses deficit models that entail one-way communication. The contextual model implies an active public and is participatory requiring rhetoric reconstruction, and is jointed between public and local knowledge (Burns et al, 2003:195-196).

3.3.9 Social trust approach

The trust-confidence-cooperation model (TCC) is one such model of risk communication used to explain the willingness of the target population to make themselves receptive to the views, decisions, and actions of the expert organisation (Twyman et al, 2008). This draws from the socio-cultural and psychological theories (Taylor-Gooby, 2004:15). In this dichotomy, the source narrates the information about a risk to the recipient, and the level of response from the recipient will depend on factors such as similarity between their values (trust in motives), ability, and competence, knowledge about the source

based on either past events, including implementation processes (trust in competence) or social networks (Twyman et al, 2008). Similarly, Ferrante (2010:40) also identifies three key factors that can assist managers to effectively foster trust in risk communications: perceptions of knowledge and expertise, perceptions of knowledge and honesty and perceptions of concern and care. This will determine whether the recipient will accept or reject information and advice on risk from the source. Evaluation studies carried out based on this concept usually involve scaling and rating the different levels of trust based on past experience and values. Twyman et al. (2008) carried out such a study by using two different advisors on similar hazards and then asking the respondents to rate the hazards based on the values and advice given prior to the exercise. Another popular study is that cited by Twyman et al., based on research from Earle and Cvetkovich (1999), where a hypothetical nuclear scheme was to be implemented and an existing organisation was nominated as the implementer of this scheme. Respondents were then asked to rate the extent to which they would trust this organisation and also complete a scale against which their values and views were similar to that of the implementing agency.

3.3.10 Social amplification of risk

This framework was developed in the USA in the 1980s and seeks to identify mediator/moderator components that interfere between the risk event and its consequences so as to identify causes and time sequences in which they occur (Breakwell, & Barnett, 2001). This aspect is very important in risk communication as it brings forth many filters of information including influences of culture, social networks, the media and other institutions involved in information dissemination. The explanation is that, some hazards tend to become a cause for public concern because social, cultural, institutional and psychological processes, despite their relatively low risk heighten them, while others are attenuated and receive little attention. Evidently this communication theory is based on the Shannon and Weaver concept of communication but takes cognisance of semantics and the influence of noise on information transmission. This leads to both positive and negative effects on behavioural patterns and generates primary and secondary impacts. Risk messages are understood as signals communicated from multiple sources and transmitted via a number of entities and as the communication filters through, it is deliberately or accidentally transformed either to amplify or attenuate the risk (Taylor-Gooby, 2004:7; Höppner et al, 2010:24-25). The framework is divided into two stages: stage one is concerned with the

primary consequences which are dependent on the nature of the hazard and the quality of the amplification stations, while stage two is concerned with secondary consequences (Breakwell, & Barnett, 2001:2). In essence, social processes as opposed to physical characteristics determine the consequences of a hazardous event, and thus this framework will tend to be valuable if social, economic, cultural and political processes that impede effective risk communication are to be evaluated. Empirical studies using this approach were carried out in UK using the layering method to determine physical consequences of the hazard, media coverage of these events including the various versions, lay perceptions and finally individual behavioural intentions. Clearly, this study is time consuming, expensive and prone to errors. The framework also fails to look into the causes but rather stresses on the consequences (Breakwell & Barnett, 2001:3). The framework has also been criticised for not carrying sufficient ground to be a theory with testable hypothesis and yet at the same time, this framework has been ambitious and carries with it a wide range of disciplinary backgrounds (Taylor-Gooby, 2004).

3.4 Critical analysis of the risk communication approaches in Cape Town

Based on the literature above, a short synopsis that critically analyses flood risk approaches in Cape Town can be deduced. Figure 3.1 below is a clear representation of the flood risk management strategy followed by the City of Cape Town.

Figure 3.1: Flood risk management plan for the city of Cape Town



Source: Wood 2007 in Bouchard et al, 2007

The city adopts a technocratic stance towards flood risk with management solutions being based on structural measures that do not incorporate community contextual backgrounds, a viewpoint that is

supported by Ziervogel and Smit (2009:3). The model is a risk assessment based model where risks are quantified and evaluated by the expert then communicated to the lay. Asymmetrical power is granted to the expert who becomes responsible for making all the appropriate decisions with regards to how the risks should be managed. This is apparent on examination of South African literature and its strong emphases on improving governance structures (Disaster Management Act, 2002; Bouchard et al, 2007; Ziervogel & Smit, 2009; Olorunfemi, 2011). Queries can therefore be brought forth on the institutional location of knowledge production. Although effective communication is highlighted as one of the main concepts to the model, a quick analysis at the solutions offered to bridge the communication gap between the expert and the lay points us towards the direction of the deficit model. Also, the resistance of the 'high' risk populations to move to less risky areas points towards an expert vs. lay gap. The boundaries between knowledge producers and consumers are well defined. Institutions merely aim to educate people so that they can share the same perceptions and behave accordingly.

The flood risk management model also leans heavily towards crisis communication. This can be seen in the policies and legislations that govern flood risk. The umbrella legislation is the Disaster Management Act (Act 57 of 2002), which aims to facilitate transversal engagement in disaster risk reduction by different stakeholders (Benjamin, 2007). It is claimed to have shifted the paradigm from reactive to pro active with a focus on community vulnerabilities. According to Ziervogel and Smit (2009), however, the attempt to be pro active has failed, while Bouchard et al, (2007) highlight ineffective communication to be still one of the problems marring flood risk management. Socio-economic vulnerability shifts serve as an attempt to involve a broader set of stakeholders into the decision-making process and to build capacities to reduce contextual vulnerabilities that contribute to exposures to hazards. While a great deal has been said and postulated about strengthening social capacities to reduce social vulnerabilities, no one has thus far tried to visualise the concept of flood risk from the bottom up approach and actually view flood risk the same way the community perceives it. Rather, every remedy is still prescriptive and comes from the top to the bottom. Although communication is often pointed at, the field of risk communication is still a field unearthed. Risk policies need to put a greater focus on how issues of risk ought to be communicated and more especially, get a little closer to the communities to critically view how risk is viewed from the other side of the door. Community perceptions need to be acknowledged and incorporated into flood risk management through divergent communication models and not merely risk assessment.

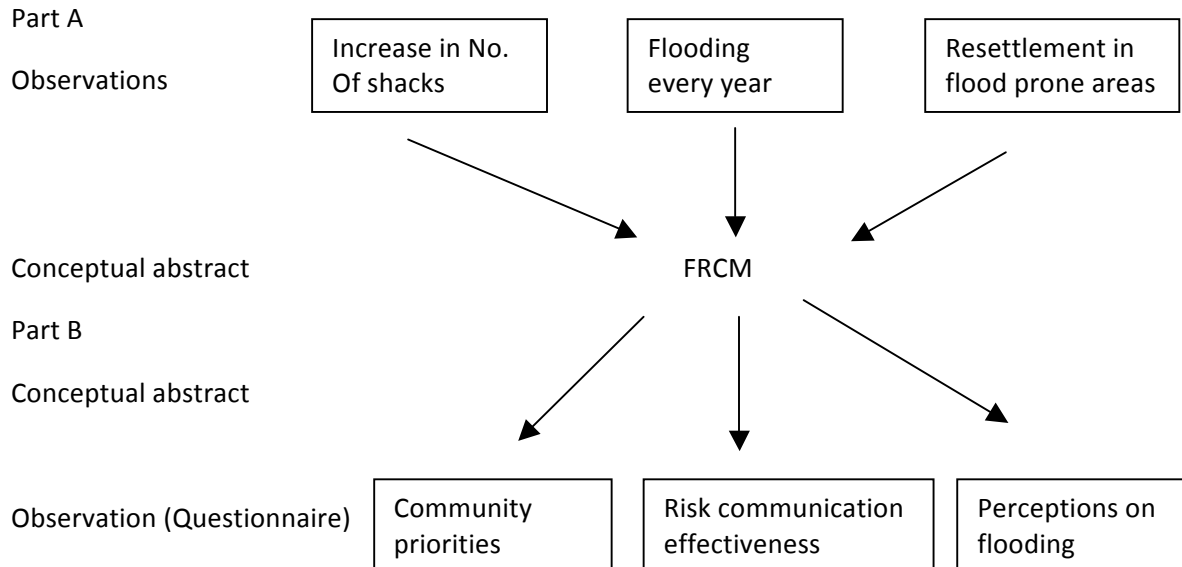
CHAPTER FOUR

This chapter is dedicated to introducing the strategies and methodologies used in this research. It begins with a brief discussion of the literature underlying the research strategy and method, and proceeds on to a discussion platform of the research questions and how they are linked to the objectives of the study. It expands further on issues of validity and reliability and explains how they were catered for using the results of the pilot study. Lastly, challenges and constraints that were experienced throughout the administration of the survey are explained.

4.1 Research strategy

As discussed in the first chapter, the main aim of this thesis is to describe and explain the influence of flood risk communication efforts on the inhabitants of informal settlements of Cape Town and how this impacts on behaviours and perceptions towards floods. Furthermore, it intends to investigate how these lay perceptions can be used to formally evaluate flood risk communication efforts. As such, the research strategy was divided into two parts, A and B. Part A consisted of gathering and studying some background information regarding flooding in informal settlements. Thereafter, a theoretical behavioural model (FRCM) was postulated. Part B sets forth to prove the postulated theory of flood risk management and communication (see figure 4.1 below) based on the information gathered from the background study as well as the postulated behavioural model. The questions for the questionnaire survey were formulated using this model.

Figure 4.1: Research strategy break down



4.2 Methodology

As discussed in previous chapters, this research takes on a phenomenological approach that has its foundations in clinical and phenomenological psychology and accommodates the subjectiveness of perceptions as well as the social constructivism approach with origins in social psychology, sociology and cultural anthropology. For a better understanding of how the actors evaluate objects, acts and indeed risk communication, one has to explore the psychological dispositions of the actor's beliefs and choices and how these aspects lead to decision-making (Kahneman, 2002:449). This includes aspects such as their status quo, their understanding of framing effects and their priorities. Therefore, the data collection instrument used was a questionnaire drafted so as to reflect the actor's psychological dispositions towards flood risk communication. Interpretive research helped to access information on past flooding experiences, how individuals prioritise issues and concerns in the particular research context, how actors evaluate risk communication efforts as well as the effectiveness of the risk communication efforts.

4.3 Examining the research questions

How do people living in areas designated as high flood risk informal settlements of Cape Town understand and evaluate flood risk communication efforts?

This is a context specific question. It requires the researcher and the administrator to be intimate with the actors' environment. Pursuant to the most fundamental principle of all in interpretive research postulated by Klein and Meyers (1999:72) on the hermeneutic circle, this question was answered by studying the geographical influences of the area as well as an intensive contextual background review, to come up with the flood risk communication model (FRCM). Of particular note were the following observations:

- Illegal informal structures are often erected in flood prone areas despite flood risk communication efforts. Figure 4.2 and 4.3 show pictures of the Graveyard pond in Philippi in two different time frames, 2007 and 2009 respectively.

Figure 4.2: The graveyard pond, Philippi, September 2007



Source: Musungu et al, 2012

Figure 4.3: The graveyard pond, Philippi, March 2009



Source: Musungu et al, 2012

- An average winter leads to as much as 4000 dwellings being affected (City of Cape Town, 2009:12).
- Bouchard et al. (2007) highlights ineffective communication. People that are flooded return to the same area when floods are gone while some refuse to move at all.
- Increase in the number of informal dwellings (City of Cape Town 2009:27).

Thus, the FRCM takes cognisance of the above field observations to conceptualise how informal settlement dwellers evaluate flood risk communication.

To what extent does the proposed Flood Risk Communication Model (FRCM) succeed in reflecting the laypersons understanding of current flood risk communication?

To gather data that answers this question, the respondents were asked to complete a questionnaire (Appendix A) that investigates perceptions towards flood risk communication efforts and psychological dispositions towards the issue of flooding in general. Because the FRCM utilises various sub disciplines in its analysis of behaviour towards risk communication, the questionnaire was designed in such a way that each sub discipline has a competitive role in order to measure the level at which it is represented (see table 4.1 below). In doing so, respondents get to choose options that they deem to be of higher priority from the others. These options were interpreted to be of greater significance in decision making with regard to the influence of risk communication efforts in their daily lives. Table 4.1 below is a diagrammatic representation of the various components of the FRCM. Each heading represents a sub discipline and the question from the survey that is applicable to it.

Table 4.1: FRCM sub-disciplines versus questionnaire structure

| Question No. | Demographic | Social Networks | Past experiences | Risk communication | Priorities Psychology | Self Report |
|---|-------------|-----------------|------------------|--------------------|-----------------------|-------------|
| 1.Housing type | • | | | | | |
| 2.Gender | • | | | | | |
| 3.Age category | • | | | | | |
| 4. Population group | • | | | | | |
| 5.Educational qualification | • | | | | | |
| 6.Occupation | • | | | | | |
| 7.Monthly income | • | | | | | |
| 8.Mome ownership | • | | | | | |
| 9.Past flood experiences; perception of seriousness; flood damages and option to relocate | | • | • | • | • | • |
| 10.flood information sources | | • | | • | | • |
| 11.AGA theme 'RISK' | | | | • | • | |
| 12.AGA theme 'FLOOD' | | | | • | • | |
| 13.AGA theme 'FLOOD' | | | | • | | |

| | | | | | | |
|--|--|---|---|---|---|--|
| PREVENTION' | | | | | | |
| 14.AGA theme 'TRUST' | | • | | • | | |
| 15.Priority problems | | | | | • | |
| 16.flood risk communication satisfaction level | | | | • | | |
| 17. General risk communication satisfaction level | | | | | • | |
| 18.Area preferences | | | | | • | |
| 19. Willingness to pay to solve flooding issues | | | | | • | |
| 20. Willingness to pay to continue living where you are | | • | | | • | |
| 21.Choice of risk communication program | | | | | • | |
| 22.Flood prediction in the area in for the next 3 to 4 years | | | • | | • | |

•Represented Field

Based on community perceptions, how effective are the current flood risk communication efforts of the City of Cape Town?

This question aimed to measure the success levels of the current flood risk communication efforts in informal settlements based on the residents' perceptions. This aspect was factored into the questionnaire in various ways so as to detract the respondent from affiliating the survey with the flood risk communication agent (City of Cape Town). This is because local governments are the most active in communities and people normally blame all the socio-economic issues on the government. In this way, the respondent bias will be reduced. Table 4.1 (above) gives a synopsis of the survey questions that were applicable to this research question.

4.4 Research approach

The epistemological approaches used in this research allowed for a broader view into the effects of risk communication in informal settlements. This approach could further allow appropriate interventions in ways that could address the actual determinants of flood risk behaviours, rather than designing programmes based on expert views and opinions that will most likely be unable to tackle the actual causes of the problem. It permits for contextual influences to be taken into consideration. According to Paul (Scrimshaw, 2001:53), "If you wish to help a community improve its health, you must learn to think

like the people of that community. Before asking a group of people to assume new health habits, it is wise to ascertain the existing habits, how these habits are linked to one another, what functions they perform, and what they mean to those who practice them.” This concept is also applicable to flood risk in informal settlements. Rogers, Popay, Williams and Latham (1997:9-10) also believe, “The contextualisation or the grounding provided by lay perspectives allows for a perspective on behaviour which acknowledges its meaning. Behaviours which are seen from ‘outside’ as negative or unhealthy may be seen from within as positive and pleasure.” These observations influenced the choice of approach, which is why the case study methodology was opted for. It involved detailed and intensive analysis of residents in informal settlements of Cape Town and allowed for a greater focus on the cases and their distinctive contexts thereby creating a framework for further discussion of the issue.

4.4.1 Study population history and development

Due to the lack of substantial literature in the development of Phiippi, most of the history in this narration is based on the report from the South African Education and Environment Program (SAEP), 2009 report by Anderson, Azari and van Wky. It appears that, Philippi today is dubbed to be one of the many and largest informal settlements located in the cape flats, with boundaries following along Landsdowne, Duinefontein, Vanguard and the R300. It includes areas such as Philippi East, Crossroads, Browns farm and Weltevreden Valley. The actual size is neither known, nor are the boundaries absolute, for instance, Anderson et al. 2009 classifies Weltevreden Valley as falling under Philippi while in some articles such as the Weltevreden Valley Small Holding Local Area Policy draft (2011:15), it specifies, “Weltevreden valley falls within the Mitchell’s Plain area.” The developmental history of the area runs as far back as the 1800s in sync with apartheid policies, which had an influence in two main ways. Firstly, it promoted development that emphasized unequal social and spatial integration at both the national and local level with the advent of policies such as the 1913 Land Act (Miraftab, 2007:603). Secondly, the lifting of the apartheid policies themselves in 1994 led to a drastic change in terms of demographics and settlements as economic opportunities arose for the marginalized people, leading to a rapid influx into informal settlements. The area is thus shaped by political, economic and social factors. Originally, the land was used for grazing but as farms were eliminated from the neighbouring Mitchell’s Plain, a large number of labourers had to settle in neighbouring areas as they did not qualify for the apartheid state’s racial housing relocation process. The same applies to a lot of immigrants from the

homelands of Transkei and Ciskei regions in the Eastern Cape, about a 1000km from the city (Barry & R  ther, 2005:43). According to the Goldstone Commission report (1993), Crossroads was brought about by this rapid urbanisation. And because the area had not been developed for the purpose of residencies due to its proximity to the airport and industry, and also because there was no housing for blacks for approximately 13 years prior to the 1980s, the first shacks were constructed. These were mostly made from wood, corrugated iron sheets and plastic (Goldstone Commission, 1993). This area became known as crossroads, and by 1975, Crossroads had an estimated population of 1100, a number which rapidly grew by 1977 to over 18000, thus forcing the hand of the government to declare it as an emergency camp in 1978 for the provision of water and the removal of refuse. A report by the Integrated Rural and Regional Development Human Sciences Research Council (2003:8) claims that, the original squatter settlement gave birth to two new formal settlements; New Crossroads and Lower Crossroads, such that today, Crossroads has the characteristics of a formal settlement although marred by the densification of backyard shacks. This is in line with Anderson et al (2009) who asserts by 1981, 1100 houses were constructed for residents. However, future development of the area was maimed by the development of Khayelitsha created for the so called 'legal' black population of Cape Town. This by no means stopped the influx of more squatters into Philippi which explains the increase in the densification of backyard shacks.

The other parts of Philippi developed rather less violently than Crossroads. Weltevreden Valley on the south west of Philippi had a small group of inhabitants in an area known as Samora Machel and did not exist prior to the 1990 yet by February 1994, it had approximately 245 households, and by November of the same calendar year, 735 shacks. The number of shacks had to increase to 1010 by June 1995 before the government would decide to commence a housing project. However, serious problems such as affordability of private land, labour and land availability led to no more than the construction of basic housing with the barest minimum safety requirements. On the other hand, Philippi east was created to offset the pressure in crossroads, and just like Crossroads, its genesis was riddled by contestations on land, housing, service delivery, leadership and issues of participation so that, it was only after the 1990s before houses could be constructed in the area (Adlard, 2008:10). However, between March 1994 and July 1996, nothing could be done except clear and level the balance of the site due to the intensity of the conflicts. By 1997, a consensus was reached to service the area first; then build houses for the beneficiaries. This resulted in 4 535 single residential units and 969 double storey medium density as opposed to RDP (Reconstruction and Development Programme) houses mainly because in 1997 the City

of Cape Town made a call to halt the construction of RDP houses. This resulted in housing contracts being between the beneficiary and the contractor whereby firstly, sites were equipped with toilet pan and stand pipe, followed by the erection of shacks to house the facility, then last but not least, the beneficiary chose a house type with the role of the government only being to oversee the administration (Adlard 2008:10).

Browns Farm was a planned settlement from the 1980s, but was also marked by violence and group conflicts (Anderson et al., 2009). There was a rapid influx of people as a reaction of fear of losing housing space and members were mobilised to prevent claimed land from being stolen, conflicts which still exist today.

4.4.2 Demographic and socio-economic structure

One cannot measure psychological dispositions especially towards a phenomenon such as flooding in isolation from the environmental context that the individual lives in. For instance, employment status can have a profound influence on the status quo of an individual and thus, it is useful according to the prospect theory. Furthermore, socio-economic context can influence issues such as understanding flood risk, structures of opportunity and access to information. The statistics used in this analysis have been adapted from the 2011 census data which were released 30 October 2012, as well as the City of Cape Town's most recent ward profiling which was published January 2013 (also see table 4.2 below). The City of Cape Town divides Philippi into five main wards: 033, 034, 035, 080 and 088. Ward 033 consists of Kosovo, Philippi and Samora Machel while ward 034 is Philippi alone. Ward 035 is Lower Crossroads, Luzuko, Philippi Industrial and Thabo Mbeki while ward 080 is another standalone area of Philippi. Last but not least, ward 088 is Lenteguer, New Woodlands, Philippi and Philippi Park (City of Cape Town, 2013). Owing to the apartheid policies, about 90% of the 205 000 people living in Philippi today (City of Cape Town, 2013) are black people, mostly of the isiXhosa tribe (Barry & Rütther, 2005:43). The total area of Philippi is claimed to be 13.16 km² (City of Cape Town, 2001), making it one of Cape Town's biggest and most populated informal settlements with a density of 15.594/km². Almost 30% of the total falls within the 0 to 14 age group while the remaining 70% is between 15 and 64. The aged population is almost non-existent at a mere one percent (1%). Because at least half the population lives in substandard housing characterised by either shacks in back yards or stand-alone shacks, only 68% have

access to piped water and a certain percentage of these have no water inside the dwelling but rather inside the yard. The rest of the population have to be content with fetching water outside the yard some of which include distances greater than 200m. The use of bucket latrines is still prominent in the area with 13% still resorting to this method. Although electricity is the major source of power, only half the population has access to electricity.

Table 4.2: Philippi ward profiling according to the 2011 census statistics

| PARAMETER | WARD 033 | WARD 034 | WARD 035 | WARD 080 | WARD 088 | AVERAGE |
|----------------------------------|----------|----------|----------|----------|----------|----------|
| Population | 43 695 | 34 393 | 40 068 | 46 151 | 40 913 | *205 220 |
| PERCENTAGE AGE CATEGORIES | | | | | | |
| 0 – 14 | 28 | 27.5 | 29.6 | 28.7 | 29.3 | 28.6 |
| 15 – 64 | 71.2 | 71.2 | 69.1 | 69.7 | 68.9 | 70.0 |
| 65+ | 0.8 | 1.3 | 1.4 | 1.6 | 1.8 | 1.4 |
| PERCENTAGE ADULT EDUCATION | | | | | | |
| None | 2 | 2.2 | 3.5 | 2.9 | 4.8 | 3.1 |
| Primary | 13.6 | 14.5 | 16 | 19.7 | 16.2 | 16 |
| Secondary | 51.6 | 50.9 | 46.6 | 50 | 48.5 | 49.5 |
| Grade 12 | 29.5 | 28.7 | 29.2 | 23.3 | 26.5 | 27.4 |
| Tertiary | 3.2 | 3.6 | 4.4 | 4 | 3.7 | 3.8 |
| PERCENTAGE DWELLING TYPE | | | | | | |
| Formal | 34.7 | 37.4 | 57.3 | 33.7 | 73.3 | 47.3 |
| Backyard shack | 18.8 | 34.1 | 28.2 | 10.6 | 11.1 | 20.6 |
| Separate shack | 46 | 27.9 | 13.9 | 55 | 14.3 | 31.4 |
| PERCENTAGE ACCESS TO SANITATION | | | | | | |
| Piped water | 54.3 | 72.9 | 88.8 | 43.3 | 85.5 | 69 |
| Flush toilet | 60.0 | 93.1 | 89.7 | 65.6 | 95.2 | 80.7 |
| Bucket | 33.1 | 1.1 | 9.1 | 19.1 | 1.9 | 12.9 |
| PERCENTAGE EMPLOYMENT AND INCOME | | | | | | |
| Unemployment | 40.28 | 35.76 | 36.46 | 37.76 | 33.4 | 36.7 |
| No income | 20.7 | 18.6 | 20.2 | 20.6 | 19.7 | 20 |
| Up to R1 600 | 32.7 | 31.8 | 29.3 | 31.2 | 27.1 | 30 |
| R1 601 - R3 200 | 26.8 | 27.6 | 25.4 | 25.7 | 20.8 | 25.3 |
| R3201 – R6 400 | 13.3 | 5 | 15.3 | 13.9 | 15.1 | 12.5 |
| R6 401 + | 6.4 | 7.3 | 9.8 | 8.6 | 17.3 | 10 |
| PERCENTAGE TENURE | | | | | | |
| Owner | 48.9 | 41.7 | 34.7 | 49.5 | 51.3 | 45.2 |
| rental | 21.1 | 25.9 | 34.9 | 13.4 | 25.3 | 24.1 |
| Rent free | 27.0 | 25.8 | 27.8 | 32.7 | 18.8 | 26.4 |

Adapted from the city of Cape Town ward profiling January 2013

*Population total

In terms of adult population educational backgrounds, almost four percent (4%) are estimated to have obtained a tertiary level status while only 50% have had some secondary education. Thus, the labour force mainly consists of manual labour occupations, crafts and related trade workers, service workers as well as shop and market side workers (City of Cape Town, 2001). Less than two percent (2%) of the total population are estimated to be employed in professional occupations. The unemployment rate stands at

37% with 20% of the population having zero income (City of Cape Town, 2013). The rest of the population have low incomes levels with a little over half (55%) earning below ZAR3200, barely enough to sustain a healthy living. In terms of tenure, 26% of the total population live rent free while 24% rent and less than half (45%) own the houses they live in.

4.4.3 Geographical location

Philippi is located at $34^{\circ}1'S18^{\circ}33'E$ in the Cape metropolitan area, Philippi's exact area and boundaries are not known, (Anderson et al, 2009).

Figure 4.4: Landsat image of Cape Town and the surrounding region



Source: Bouchard et al, 2007:9

To the west, this expansive low-lying area is limited by rising ground that slopes towards the mountainous Cape Peninsula. On the east are the mountainous regions of the Boland. Figure 4.4 (above) shows the geography of these low plains and surrounding highs. Because of the geology of the area, the cape flats were designated as unproductive land and therefore became industrial zones and urban sprawl areas. The area is underlain by Aeolian sand of marine origin blown up over many years. Below these vast sands is Malmesbury shale. The climate is Mediterranean, driven by the position of the Southern African subcontinent in relation to the low pressure westerly waves that move from west to east between 40° and 50° south (Midgely, Chapman, Hewitson, Johnston, De Wit, Ziervogel, Mukhebir, Van Niekerk, Tadross, Van Wilgen, Kgope, Morant, Theron, Scholes and Forsyth, 2005). Thus, low-pressure cold fronts and orographic rain from the two mountainous zones bring rainfall to the Western Cape. This combination has had disastrous consequences in the past and coupled with a high water

table, a Mediterranean type climate and surrounding mountainous areas, floods are inevitable especially in the months of July and August.

4.4.4 Sampling points and respondents

Figure 4.5: Sampling area



The respondents that were selected for this research came from a non-probability sample. An attempt was made to select respondents that were as representative as possible of the population structure. Figure 4.5 (above) is a map showing the area sampled. Three sampling points were chosen: Shoprite shopping mall, Browns farm library, and Philippi train station. Sampling the library, targeted respondents of a school going age group mainly because of literacy issues, and also to show case the level of flood risk knowledge in school curricula. Respondents between Grade 8 to grade 12 were chosen. Introducing flood risk education in school curricula is one of the proactive measures employed by the City of Cape Town. The train station was sampled in order to aim for the economically active population. Rail transport is one of the major forms of transport in Philippi and as such, a lot of people use trains to travel to and from work. Shoprite shopping mall is the major shopping centre in Philippi and attracts residents from all over the area. These people were at leisure. Furthermore it catered for the economically inactive since the survey was conducted during the day on a working week day when the

working population is supposedly at work. This was important because the population of the unemployed is high at approximately 37% and therefore significant for this study.

4.5 Field work preparation

The fieldwork preparation started in the middle of September and began with seeking ethical approval, research assistants, training and pilot testing of research instruments.

4.5.1 Ethical approval

Before the survey commenced, ethical approval was sought from the Faculty of Applied Sciences Ethics Committee of the Cape Peninsula University of Technology (CPUT), which determined whether the study should commence or not. Furthermore consent forms were attached to all the questionnaires. Only the signature or initials from the respondent were required to show that the respondent consented to filling in the questionnaire. It was mandatory for all of them to write down their places of residence as an assurance that the study was confined to the case study area. Full residential addresses were not required.

4.5.2 Recruitment and training

The study recruited internship students as RAs (Research Assistants) who helped with the data collection and processing. A fellow lecturer of the university recommended a few interns and carried out the recruitment process. Two basic requirements applied: All the RAs should be fluent in Xhosa and some of the RAs should reside in Philippi. The RAs went through a two-day training program (20-21 September) on the background of the study as well as on how to reduce sampling errors such as bias. A total of four RAs were trained. The RAs were also used on the finalisation of the questionnaire as well as brainstorming on the most appropriate sampling points.

4.5.3 Pilot Study

The pilot study was done to pre-test the data collection instrument. The questionnaire was piloted on the university premises to fellow students at random. A total of 40 questionnaires were distributed. The time taken to complete each questionnaire was recorded and the average time plus an additional 10 minutes were slotted as the average time it will take to administer the questionnaire in the case study area. The additional time slot was to cater for issues of literacy. The pilot study took one full day to be completed.

The results showed that some of the questions were unclear and had to be rephrased. Of particular concern were the AGA questions. Not only did these questions need explicit instructions, but the RAs also needed extra training with regard to these questions. Some questions were found to require similar answers, but because this was a psychology test, the duplicated questions were not removed; rather the questions were framed differently to serve on internal reliability of the questionnaire. Only important questions that formed the focal point of the study were repeated in this way. Important questions such as self-report questions were used for data triangulation to measure whether the respondents were consistent in relating their experiences. It was also decided that the process should be interactive to ensure that all questions are clear and to cater for literacy issues.

4.6 Data collection and quality assurance mechanisms

Several data quality assurance measures were employed. To ensure reliability, the level of trustworthiness and credibility of the data was enhanced by repetition and reframing. Important questions such as flooding experiences were framed and reframed in different ways but required similar answers. Figures 5.13 and 5.16 in the next chapter show case this mechanism applied for questions 19; 20; 16 and 17. The use of all applicable languages ensured issues of literacy were catered for. Additionally, the use of local people for data collection enhanced reliability.

Construct validity was also an important part of quality assurance in this research especially pertaining to AGA type questions. Although originally the concept gives a one minute time slot to measure the ease with which certain responses come to mind, in this case, association whether conscious or unconscious

was more important than the ease with which responses come to mind. To ascertain that the questionnaire was measuring the theoretical construct that it is supposed to measure, independent judges were used to group the responses according to the degree of correlation amongst the different responses from different respondents. This is to say, if one respondent writes the word *family* as a response to an AGA type question on TRUST, while another respondent answers *friend* to the same question, it automatically means there is a high degree of similarity. These responses can therefore be grouped together on the basis of them indicating some human relationship. Hence, the question is valid. However, an answer such as *tree* falls out of category because it is an inanimate object, meaning the questionnaire is not generating the answers that it is supposed to. Thus independent judges were used for this task to reduce bias.

Other mechanisms used to ascertain high quality responses included, training of RAs, the use of dichotomous variables where information was restricted to 'yes' or 'no' answers, and last but not least, an interactive method of data collection.

4.6.1 Data Collection

For a 10-point confidence and 95% confidence level, a sample of 96 respondents was needed for this study. The 2001 census data of 110 000 was used to determine this figure because the 2011 census data was embargoed at this time and therefore, unavailable. To cater for possible sampling errors, 120 questionnaires were distributed. The survey was conducted early October 2012 towards the end of the rainy season while flooding experiences were still fresh in the minds of the respondents. It took two full days (1st and 2nd) to administer all the questionnaires and complete the survey. Each questionnaire was given on average 30 minutes to complete.

4.6.2 Challenges

After the initial data collection, the RAs were asked to report some of the difficulties they experienced in the field. Some of the problems included:

- At the rail station, trains had a specific timetable and some of the trains arrived before the respondents could complete all the questions. This was a problem that was rectified immediately as the interviewers compromised by checking the timetable and administering the questionnaires platform-by-platform depending on the timetable.
- Some respondents refused to answer questionnaires written in English disregarding the fact that the RAs administered it in isiXhosa. For future studies it is recommended to have questionnaires written in English and other local languages.
- At the library, the predicted turnout was low because schools were closing the following day. However, this turnout was more than made up for by the high population turnout at the shopping mall because it was the end of the month and people were paid.

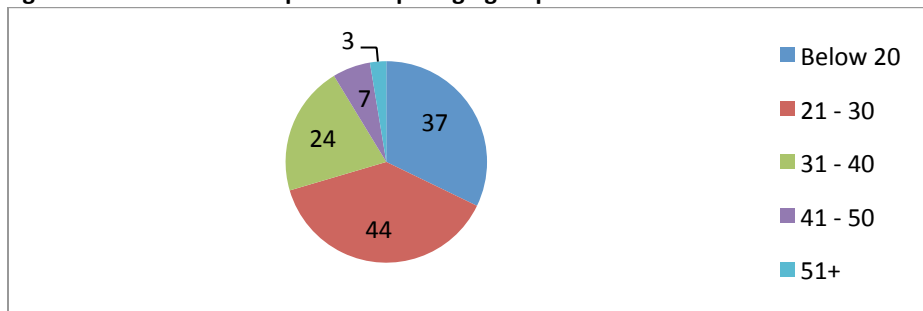
CHAPTER 5

The analysis has been divided into two main categories based on the research questions: the extent to which the responses fit the FRCM and an evaluation of the current flood risk communication in the area. The first research question was answered by the FRCM. The second research question will be answered in this current analysis. Table 4.1 in the previous chapter represented the questionnaire in its various sub disciplines. The FRCM is divided into three major areas that influence perception of flood risk communication: social networks, cognition and past experiences. The extent to which the FRCM relates to the sample population's dispositions will therefore be answered by the relevance of the various influences or sub-disciplines to the model. Various questions have also been included to answer the research question pertaining to the evaluation of flood risk communication. The empirical findings are presented in this chapter.

5.1 Demographics profile of the sample population

Out of 120 people sampled, 115 questionnaires were considered. The rest of the questionnaires were discarded because the respondents were non-residents of informal settlements. The results show that the majority of the population sampled, 94.78% associate themselves with the Black African origins. Females constitute a little more than half of the respondents at 53.9%. The chart below represents the age categories that participated in the survey.

Figure 5.1: Number of respondents per age group



Although the number of respondents above 40 years of age seemed to be under represented in the sample population, age was not considered to be an important variable for the purposes of the survey. Respondents of school going age were considered because introductory flood risk education in school curriculums was presented by the City of Cape Town as one of the proactive measures implemented to reduce flood risk in informal settlements. The results showed approximately ten per cent (10%) of the sampled population as having no formal education, while a little more than half (56%) had a matric level qualification. However, despite the high number of matriculates, only eight per cent (8%) had a post matric qualification in terms of diploma or certificate. An estimated 44% of the respondents were unemployed with an additional 15% being self-employed. The salary per month fell under the zero (0) to ZAR2000 bracket for 87% of the respondents, with a mere six per cent (6%) being between the ZAR2001 to ZAR4000 bracket. In terms of home ownership, 28% were estimated to own the houses they live in while 36% were tenants. Almost 40% of the respondents live in shacks and 35% live in RDP houses.

5.2 FRCM analysis

The following sections represent the analysis of data pertaining to the FRCM. A rationale is presented to allow for a better understanding of the transition from theory and literature to hypotheses, then data and lastly, the results.

5.2.1 Rationale behind past experiences

This section seeks to answer the question: *Are past experiences relevant in shaping flood risk perceptions in informal settlements?* According to Tversky and Kahneman (1973:164), a person could estimate the likelihood of an occurrence by assessing the ease with which the relevant mental operation of retrieval, construction or association can be carried out. This theory is particularly applicable as flooding is an event that can easily be reduced to relative frequencies. This is known as the availability heuristic and was used in this research as the basis upon which past experience play a psychological role in decision making pertaining to flooding. It exploits one of the oldest laws of memory, which states that repetition strengthens associative bonds. Tversky and Kahneman use the inverse of this law, and assess availability as a mediating variable, in this research however, it was used it as a dependant variable such

that availability becomes dependent upon whether the respondent has experienced flooding events in the past. Although it is acknowledged that availability leads to systematic errors in judgement, for instance one might answer 'yes' to past flooding based on whether he/she has had friends and neighbours who have been affected by flooding in the past, but not necessarily experienced it first hand; for the purpose of this research such systematic biases are considered relevant.

Two questions were formulated in the survey in order to measure past flooding experiences; question nine (9) where respondents were asked about their past flood experiences and question 22 where respondents were asked to forecast future flooding occurrences. Question 22 had a poor response rate, most probably because it was the last question on the survey and therefore highly subjected to time constraints. Therefore, it was ruled out from the analysis. Past experiences are taken to refer to flooding events that occurred in previous years as well as flood related damages. Because this research aimed to analyse how people evaluate risk communication, current risk reduction measures as promoted by the City of Cape Town were analysed from literature and it was realised that the highest priority was to encourage people to relocate from areas designated as 'high risk'. Thus, it became essential to measure whether there was any association between past flooding experiences and the decision to relocate to areas of a lower risk priority.

Literature also revealed that, despite the current efforts to communicate about flooding in informal settlements, people still opted to settle in areas considered as high risk. This is in particular the case with the graveyard pond in Philippi (see figures 4.2 and 4.3) in the previous chapter. This led to the hypothesis that there are significant differences between the expert perception of flood risk and that of the layperson. Otherwise, if experts designated certain areas as high risk and similar perceptions were shared by laypersons, there would not be an influx of people into such areas. At this point, it becomes also important to test whether there was an association between past flood experiences and the seriousness with which flooding is perceived.

Tests for association were conducted using the X^2 (Chi-square) analysis. If past flooding experiences are associated with decisions to relocate and the seriousness with which flooding is perceived, it will follow that past experiences with flooding are relevant in shaping the way residents of Philippi evaluate flood risk communication. The following hypotheses were tested:

- H_1 : Past flooding experiences and the decision to relocate are independent of each other

- H₂: Past flooding experiences and the perception of seriousness are independent of each other

5.2.1.1 Patterns and results

Table 5.1: Contingency tables for relocation and flooding seriousness versus flooding experiences

| Flooding experience** | Relocation option | | | Flooding as a serious | | |
|-----------------------|-------------------|-----|---------|-----------------------|-----|---------|
| | Yes | No | Total | Yes | No | Total |
| Yes | 29 | 15 | 44 | 37 | 8 | 45 |
| | 66% | 34% | 39% | 82% | 18% | 39% |
| No | 18 | 50 | 68 | 31 | 38 | 69 |
| | 26% | 74% | 61% | 45% | 55% | 61% |
| Total | 47 | 65 | (N)112* | 68 | 46 | (N)114* |
| | 42% | 58% | 100% | 60% | 40% | 100% |

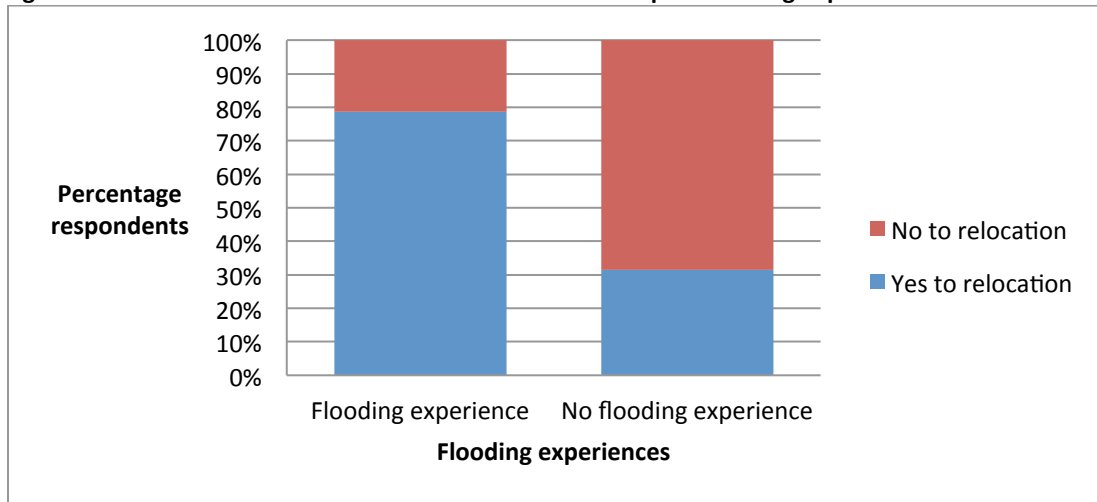
NB* differences in (N) are due to non-response from other people.

** Although flooding experience is the independent variable for convenience it is in the column section

Examination of the cell frequencies as shown in Table 5.1 above shows that out of a total of 112 people that responded to this question, 39% (44) have experienced flooding while a little more than half (61%) have not experienced flooding before. And yet, out of the 39% that have experienced flooding, 66% of them (29 out of 44) have considered relocating to a flood free zone while the remaining 34% (15 out of 44) have not considered relocation at all. Hence, more than half of the people that have experienced flooding have considered moving to another area.

On the other hand, more than half the respondents have not experienced flooding (61%) and out of this total, the majority, 74% have not considered the option of relocating. Clearly there is a greater tendency for people that have experienced flooding to consider relocating as opposed to those that have not experienced flooding at all. Figure 5.2 shows this polarisation.

Figure 5.2: Polarisation between decision to relocate and past flooding experiences



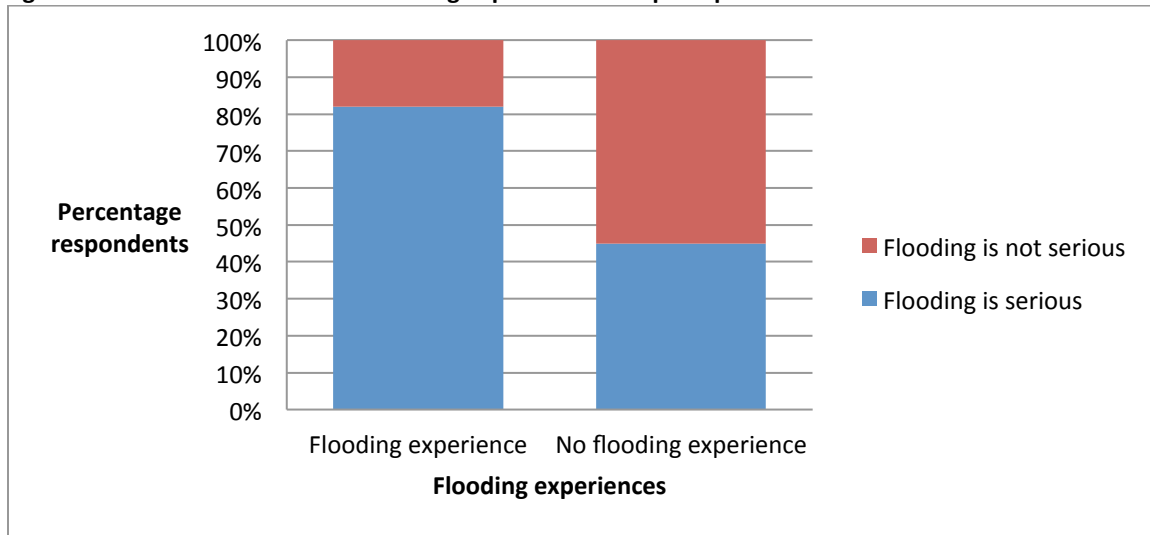
The chi-square test for association between flooding and relocation (table 5.2 below) indicates that the null hypothesis can be rejected ($p = 0.001$) and the alternative hypothesis that there is an association between flooding experiences and the decision to relocate is accepted.

Table 5.2: Chi square test for association between flooding experiences and the decision to relocate

| Test | Value | df | p | Association |
|---|-------|----|-------|-------------|
| Past flooding experiences vs. decision to relocate | 17 | 1 | 0.001 | $P \neq P$ |
| Past flooding experiences vs. Seriousness of flooding | 15.8 | 1 | 0.001 | |

Table 5.1 also shows the relationship between past flooding experiences and the perception of respondents towards its seriousness. Out of the 45 (39%) that have experienced flooding, the majority of the respondents, 82% (37) consider floods to be a serious problem. At the same time, more than half the people that have not experienced flooding (55%) consider flooding to be a minor issue. Therefore, there is a tendency for people that have experienced flooding in the past to perceive floods as serious while those that have not experienced flooding in the past regard it as insignificant. Figure 5.3 (below) shows this polarisation.

Figure 5.3: Polarisation between flooding experiences and perception of seriousness



According to the chi-square test for association between flooding and perception of seriousness (table 5.2 above), the null hypothesis is rejected ($p=0.001$) and the alternative hypothesis that there is an association between flooding experiences and the perception of seriousness is accepted.

5.2.2 Rationale behind flood damages

Flooding can lead to a lot of adverse effects such as loss of life, loss of property and livelihoods. Damage to property was therefore considered as a direct consequence of past experiences. The rationale behind investigating past flood damages is based on Tversky and Kahneman's (1991:1039) loss aversion reference dependant model. In this model, people are averse to losses. Losses and disadvantages have greater impact on preferences than gains of an equal value. The model has three essential properties:

- *Reference dependence* where the carriers of value are gains and losses based on a particular reference point.
- *Loss aversion* is steeper in the negative than in the positive. Losses loom larger than gains.
- *Diminishing sensitivity* where marginal values of both gains and losses decrease with their size.

The part most relevant is the loss aversion. This enables a person to regard flooding either as a serious problem or not and therefore to make decisions to relocate based on this perception. From this, it can

be deduced whether past flood damages are relevant in decision making. The following hypotheses were therefore tested:

- H₃: Past flood damages and the decision to relocate are independent of each other

5.2.2.1 Patterns and results

Table 5.3: Contingency tables for relocation and flood damages

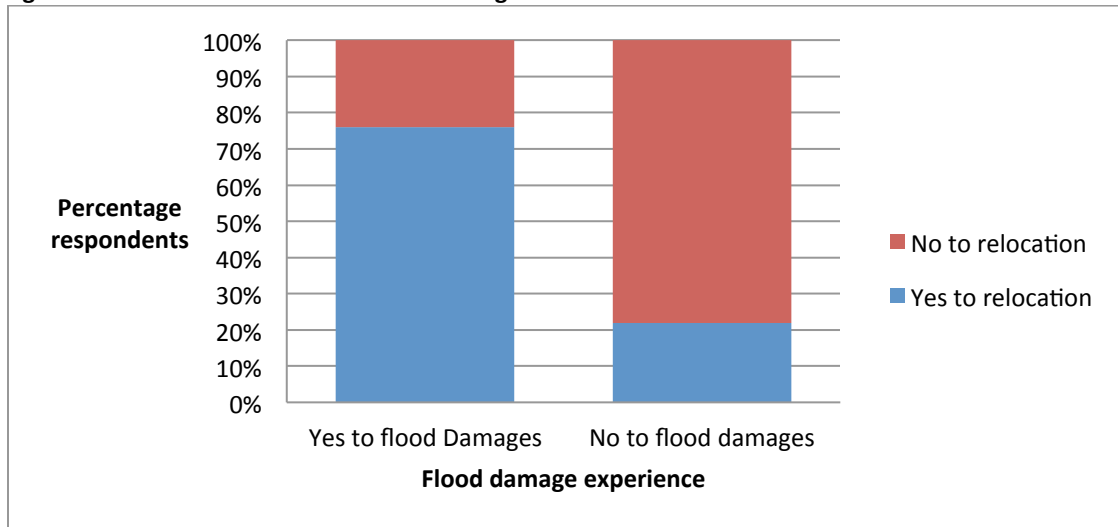
| Flood damages* | Relocation option | | Total |
|----------------|-------------------|-----|----------|
| | Yes | No | |
| Yes | 27 | 7 | 34 |
| | 79% | 21% | 31% |
| No | 19 | 57 | 76 |
| | 25% | 75% | 69% |
| Total | 46 | 64 | (N) 110* |
| | 42% | 58% | 100% |

NB* differences in (N) are due to omitted questions

**Although flooding experiences is the independent variable for convenience it's in the column section

Examination of cell frequencies in table 5.3 above shows that 34 out of 110 respondents have experienced flood damages, a figure which is consistent with the 45 out of 115 respondents who have encountered flooding problems. From the 34 (31%), the majority 79% (27) have considered relocating to a flood free zone. The remaining 76 (69%) of the respondents have not experienced flood damages before and from these, 57 (75%) have not considered the option of relocating. Therefore, there is a greater tendency from people that have experienced flood damages to consider the option of relocating as opposed to people that have not. Figure 5.4 shows this polarisation.

Figure 5.4: Polarisation between flood damages and the decision to relocate



According to the chi-square test for association between past flood damages and the decision to relocate (table 5.3 above), the null hypothesis is rejected ($p=0.001$) and the alternative hypothesis that there is an association between flooding experiences and the decision to relocate is accepted.

5.2.3 Rationale behind social networks

The following sections attempt to measure the value placed upon day-to-day interactions with individuals and organisations in as far as information gathering and sharing is concerned. Again, the sections will commence by a presentation of the rationale behind the questions. The data will then be analysed and results presented.

This part of the FRCM stems from the trust and cultural theories of social interaction and has been factored into the survey using question ten (10), where respondents are asked to choose information sources from a list and question 14, where respondents were asked to write down responses to the trust theme. Literature revealed that the City of Cape Town attempts to use multiple methods to warn people about the risk of floods in their respective areas. Question ten represents a list of potential sources that could be of use in risk communication (including sources in current use by the City of Cape Town and sources that could be used for risk communication from the cultural perspective of information retrieval and processing). Instead of respondents being asked to choose one source,

respondents could actually choose multiple sources. Frequencies for each source were then presented. Question ten was designed to evaluate current risk communication strategies to measure their effectiveness, while the secondary role was to act as a trigger to AGA questions to enable respondents to form abstract associations related to flood risk information sources.

Question 14 on the other hand used a deductive research strategy. The AGA technique was used to deduce the factors that people associate with the theme 'Trust'. Trust in environmental risk management is a concept first introduced by Paul Slovic. Slovic found that high public concern about a risk issue is related to the level of trust between the recipients of a risk communication and the authorities responsible for managing that risk. He postulates that trust in environmental management is negatively related to risk perception (Slovic, 1993:675). Therefore, the field of risk communication was developed in the 1980s in order to bridge the gap between expert and lay perception. It was strongly believed that if levels of trust could be affected then levels of risk perception could be equally affected. This is a concept and phenomena well exploited in the AGA technique. It can be argued that the first words that a respondent thinks of highlights their true associations to the theme. The theme itself comes from theories of trust in risk communication. The relationship between the governing institution and the lay will determine the extent to which the lay takes cognisance of risk communication. In order to better conceptualise the relationship between the theme and the aim of the overall research, respondents were asked AGA questions with themes such as 'Floods' and 'flood prevention' *before* being asked about trust. This added an unconscious bias to the theme, hence, instead of thinking of the theme 'trust' as a stand-alone, one automatically thought of 'trust in flood risk communication.'

The numbers of responses from the AGA were then grouped into domains by independent judges. Responses with the same root meaning were considered to belong to the same group. The dominance score could then be calculated. The dominance score relates to the domain with the highest score amongst all the responses. Therefore, it shows the most relevant domain to the group under that particular theme.

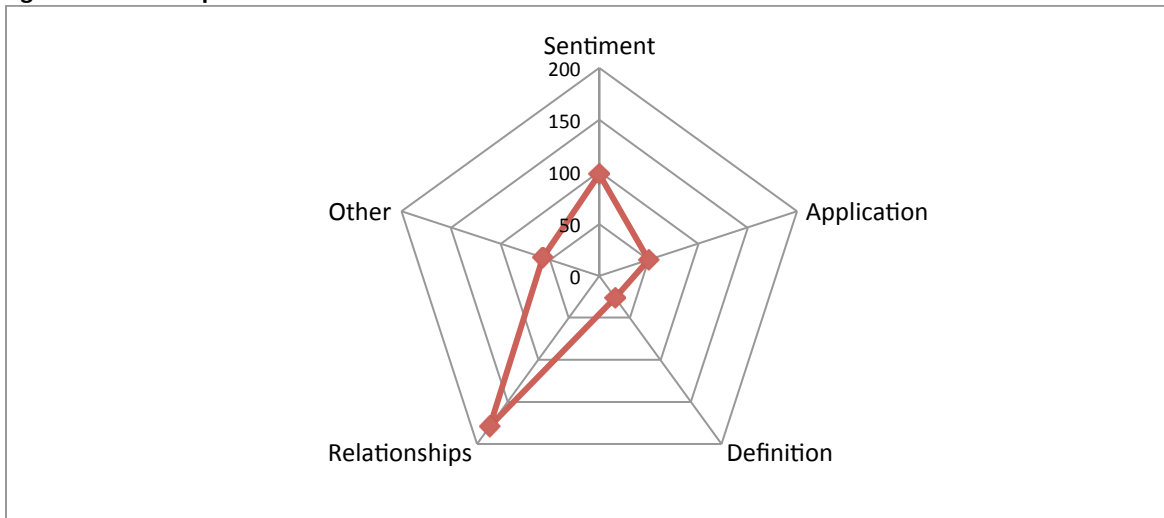
5.2.3.1 Patterns and Results

Since, the main question posed in this objective is how relevant are social filters in influencing perceptions, the assessment will begin by analysing the responses to the AGA. The AGA will provide answers to what social filters are meaningful to the group. Through content analysis, the judges managed to break down the responses into 5 domains, see appendix B. These are: Sentiment; Definitions; Applications; Relationships and Other. The groups are described below:

- Sentiment – a thought, view or attitude based on emotion or feeling e.g. faithful.
- Relationships – dealings between one party to another, inference of association to another party e.g. friend.
- Definition - A statement that explains the meaning of a term.
- Application – the special use or purpose to which something is put.
- Other – different from that or those specified or implied.

The themes and the scores are represented graphically as follows:

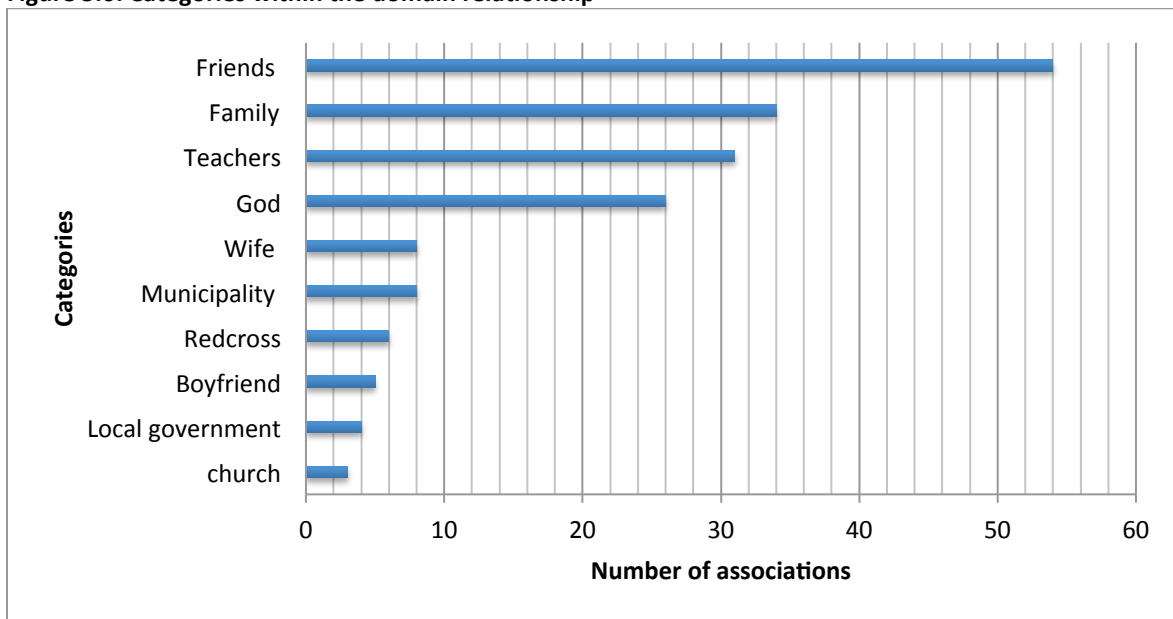
Figure 5.5: Scores per domain for the trust theme



Because, 115 respondents were sampled, and 5 associations per person were expected under the given time frame, there were a total of 575 possible associations. However, 410 (71%) associations were obtained which gives an average of 3.5 responses per person. The graph (figure 5.5 above) shows that most responses tended to be polarised towards the relationship domain, which scored 179 out of 410

(44%). Therefore, it is the most highly ranked determinant of information evaluation. The sentiment domain then followed with 98 out of 410 responses (24%). Definitions, applications and other responses played a minor role in the theme. In essence, most responses to the theme of trust are sentimental and based on relationships. A breakdown of the relationship domain is depicted in figure 5.6 below.

Figure 5.6: Categories within the domain relationship



Most responses were related to family and friends, and then followed by representations of communal activities such as teachers in schools and God. Because groups such as family, wife and boyfriend fall within similar categories, so does church and God, municipality and local government, the graph can be compounded further to show only the main categories (see figure 5.7 below). The representative heuristic was used in this regard; elements that fall within the same parent phenomenon are often used inter-changeably. Within the relationships domain, 33% of the filters are associated with friendship while 23% are associated with family. Thus, we can conclude the most influential relationships in flood risk communication are based on friendships and family.

Figure 5.7: Main categories within the relationship domain

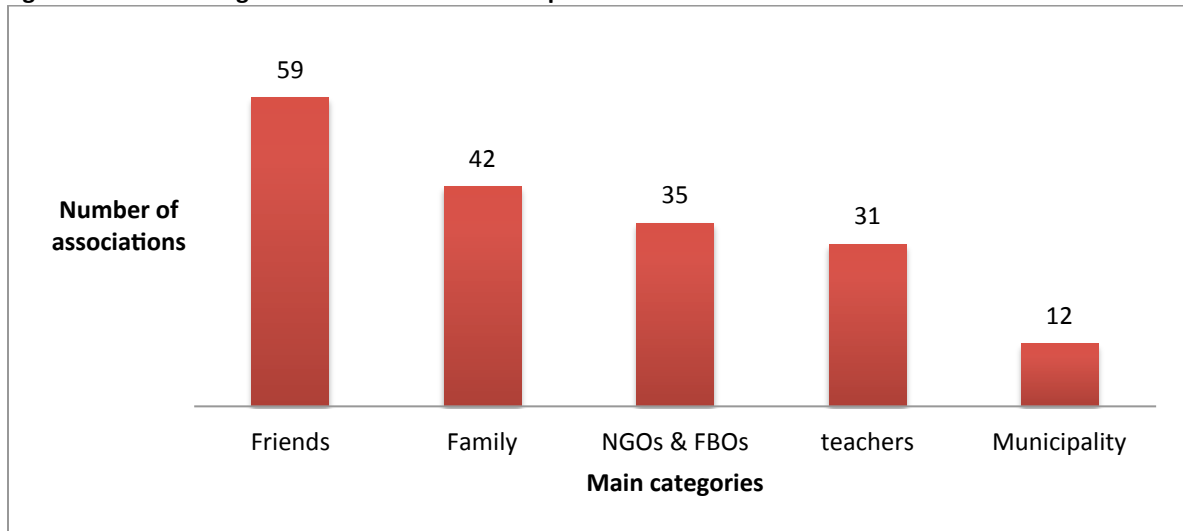
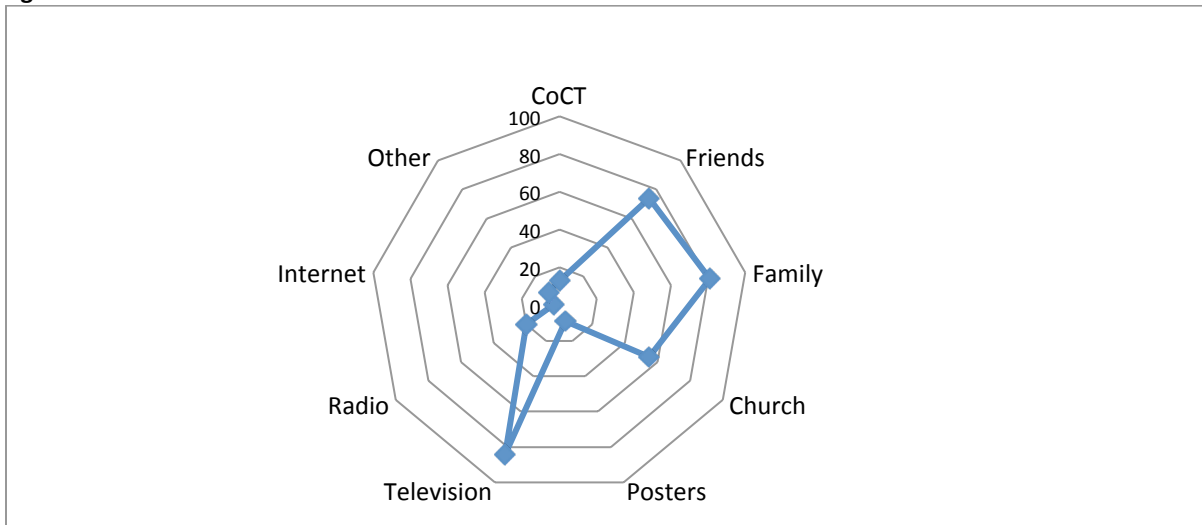


Figure 5.7 (above) shows the main categories within the relationship domain in actual numbers of associations. NGOs refer to organisations such as the Red Cross society while FBOs are mostly churches. Around 20% (35) of the responses associate trust in flood risk communication with these organisations. Teachers also play a significant role with 17% (31) of the responses being associated with them. Local government and municipalities on the other hand play a limited role in influencing flood risk because only 7% (12) of the responses associated trust with them. Most respondents therefore, have faith in family, friends, schools and churches but have limited trust in the risk communication managers. These responses should be compared with question ten which aims to determine which sources of information people use to gather information pertaining to floods.

Figure 5.8 (below) shows the responses to question ten pertaining to sources of information. Most respondents according to the analysis on the AGA theme of trust presented above, and figure 5.8, are shown to rely on family and friends for their flood risk information. This is in line with figure 5.8 where family and friend associations at 81% and 74% dominate most responses to information sources respectively. Churches also feature in both questions. Next to family and friends, figure 5.8 shows the second most used source of information as being churches at 55%, while figure 5.7 also shows after family and friends, respondents associate trust with their churches and NGOs such as the Red Cross. Although the Red Cross was not featured in figure 5.8, this could be easily attributed to the fact that, the options were limited. Teachers also did not feature in the sources of information, an error only noticed after data collection. Education from schools is clearly an option that should have been given. Television

is also a main source of information presumably due to availability and also because it is a family oriented activity. City of Cape Town scored very low in both questions, a factor which is very relevant in this research since the research aims to evaluate flood risk communication. This will be discussed further in section 5.5

Figure 5.8: Sources of flood risk information



5.3 Priorities and psychology

Measuring priorities gives us an indication of what is most important to the respondents. It allows risk communication to focus on issues most relevant to the group and not necessarily to the expert. By measuring priorities, the relevance of flood risk can be measured against the relevance of other issues that respondents consider as important. Priorities also help to decipher the status quo of the respondents.

5.3.1 Rationale behind the questions

This section further investigates the question: To what extent does the proposed Flood Risk Communication Model (FRCM) succeed in reflecting the layperson’s evaluation of current flood risk communication? As seen from literature, flood risk communication in the City of Cape Town assumes that people in designated high flood risk informal settlements:

- Will be effective in pursuing their goals.
- Especially if they have incentives such as reduced risks to health, property etc.
- And opportunities such as relocating to flood free zones that include standard housing.
- And also after having experienced floods in the past that have threatened their health, property etc.

It makes sense to the expert that, people living in high flood risk informal settlements would grasp the first opportunity possible to reduce risk and harm to themselves and their property. Indeed, according to the normative model for decision-making, people are expected to make decisions and choices that will better their situation (Tversky & Kahneman, 1986:S251). However, in spite of the logic, the incentives and the opportunities offered by the risk communication, people living in designated high flood risk informal settlements of Cape Town still show deviations of actual behaviour from the normative model. This leads us to the conclusion that an internally consistent set of subjective probabilities can be incompatible with other beliefs held by the individual under analysis. Thus, the lay and the expert can have completely different reference points that ultimately lead to deviations in expected behaviour. For instance, the decision to stay in and move into high flood risk areas such as the graveyard pond in Philippi is one such deviation. The questions have been designed according to the prospect theory to test for framing effects and measure respondents' reference points with regards to the issue of flooding.

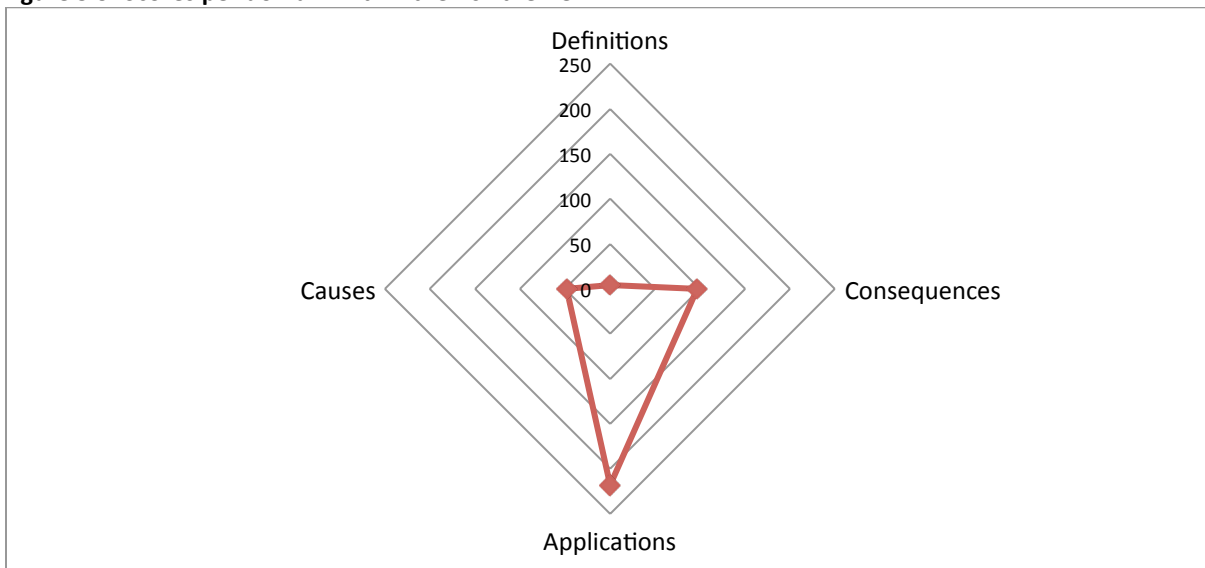
Question nine (9) on past flood experience, damages and perception of seriousness serves as a platform to investigate the number of respondents that consider flooding to be a serious problem as well as the number of people that have actually considered relocating because of floods. According to the results, 60% of the respondents' perceive flooding to be a serious problem while less than half the respondents (40%) feel that it is a minor issue, and yet only 42% have considered relocation.

Since, the FRCM is founded on the descriptive psychological model as opposed to the normative model, it is imperative that respondents' psychological dispositions towards certain issues pertaining to flood risk and flood risk communication be measured. In question 11, respondents are asked to write down the first word that comes to their mind in relation to the word risk. The assumption was if flood risk has had a profound influence in the lives of the respondents, responses pertaining to flooding would generate more associations. Independent judges broke down the responses into 4 domains, see appendix B. These are: Definitions; Applications; Consequences and Causes. The groups are:

- Definition - A statement that explains the meaning of a term.
- Application – the special use or purpose to which something is put.
- Causes – instigating or motivating factors.
- Consequences – effects.

Because 115 respondents were sampled, and 5 associations per person were expected, a total of 575 associations were expected. However, only a total of 367 (71%) associations were given. This gives an average of 3 responses per person. The themes and the scores are represented in figure 5.9 below:

Figure 5.9: Scores per domain within the risk theme



A negligible number of respondents gave definitions to the question, 4 out of 367 (1%) while the most notable responses, 218 (68%) fell within the application category. Also a sizeable amount of responses, 97 out of 367 (26%) were associated with consequences of risky behaviour while the remaining 48 (13%) of the responses were associated with causes of risk. However most relevant to the objective is to find out how many responses are associated with floods compared to other risk applications. The following graph depicts the number of associations within the applications domain:

Figure 5.10: Associations within the application domain

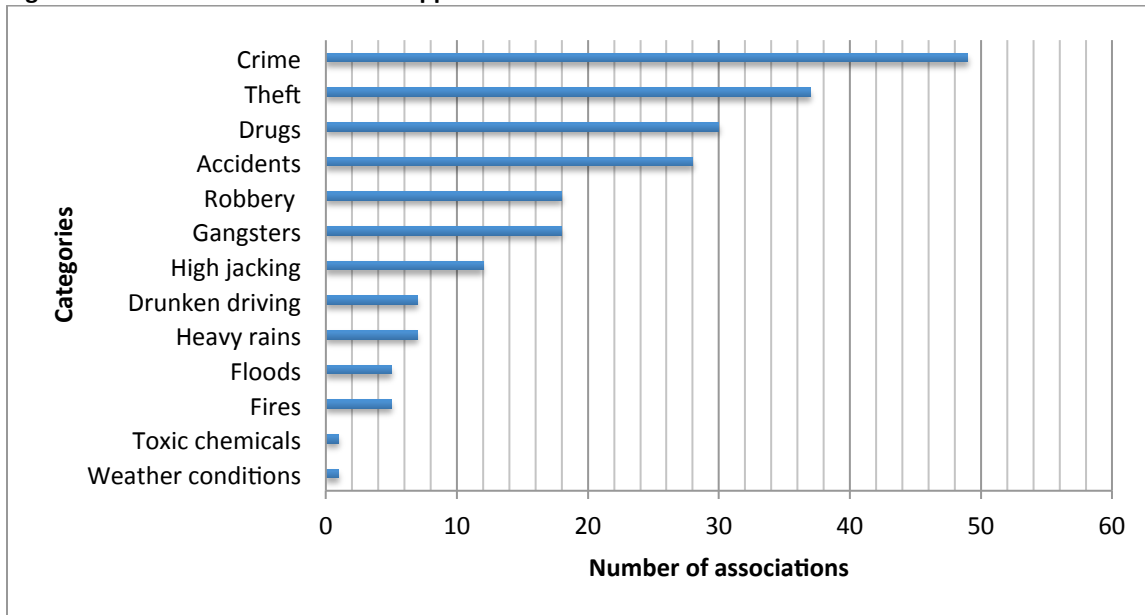
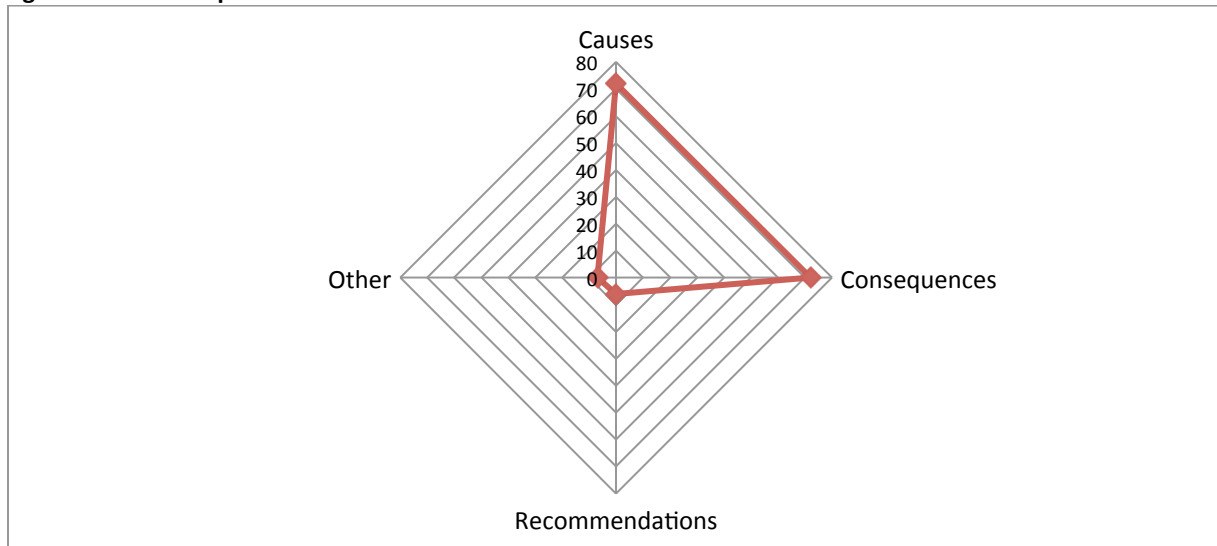


Figure 5.10 clearly shows the most prominent applications or associations to the word 'risk' fall within the crime, theft, drugs and accident categories. These associations are more vivid for the respondents than other categories such as natural disasters. On the other hand, 4 categories of natural disasters featured in the associations including floods, weather conditions, fires and heavy rains. Using Tversky and Kahneman's representative heuristic, we can classify heavy rains, floods, weather conditions under one bracket. Floods and natural disasters however come secondary to compared to issues such as drugs, theft, crime and accidents.

The AGA question type on floods (question 12) was aimed to test the respondents' understanding of the term floods and what they associate it with. Expected responses included definitions as per past experiences and causes, consequences and solutions or precautions as per the risk communication. The response rate for this question was also very low with 157 associations out of an expected 575 possible associations, giving a 27% response rate. The graph below shows the responses by category.

Figure 5.11: Scores per domain within the flood theme

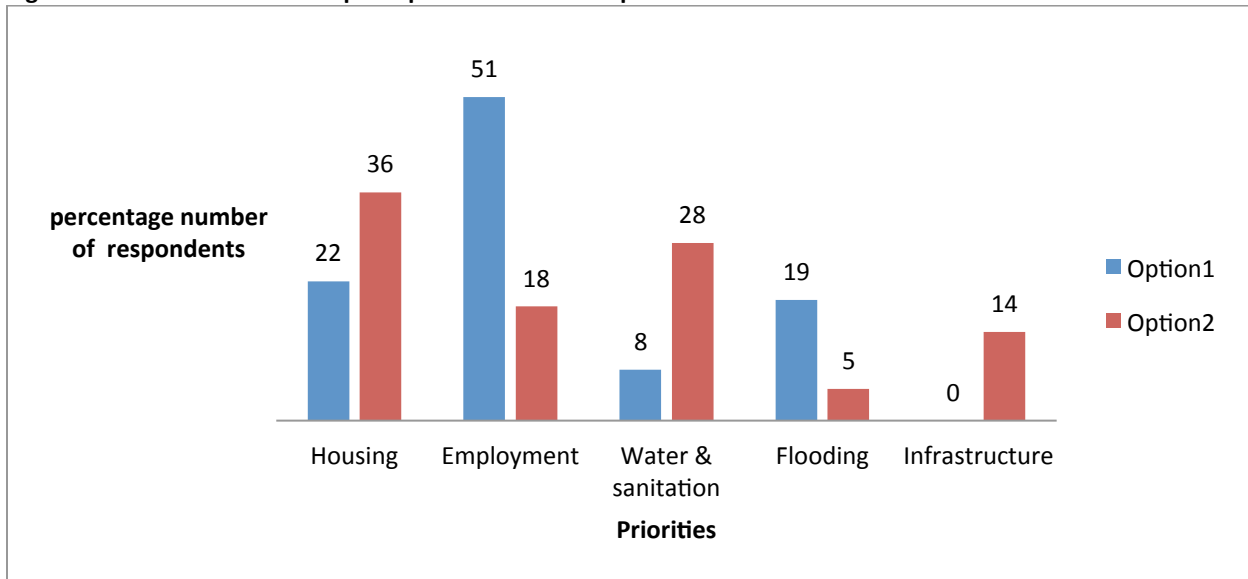


Causes and consequences had similar response rates at 76 out of 157 (46%) each while the remaining 8% were categorised as either recommendations or 'other'. The 'other' category mainly consisted of 'I don't know'. Therefore, as much as the respondents were well versed with causes and consequences of floods, they were very poor in their knowledge of how to combat them.

5.3.2 Priorities

This question was designed to get an abstract measure of the status quo of the respondents in terms of the prospect theory. According to the theory, people will weigh risks according to priorities. The graph highlighted below (figure 5.12) shows the respondents' priority options. Approximately half the respondents (51%) prefer that the government solve employment issues compared to other priority issues. Housing and flooding then follow at 22% and 19% respectively. Thus, in the face of all the socio-economic problems that plague informal settlements, flooding takes the back seat. Even as a second option, only 5% of the respondents consider flooding to be high priority.

Figure 5.12: First and second option priorities of the respondents



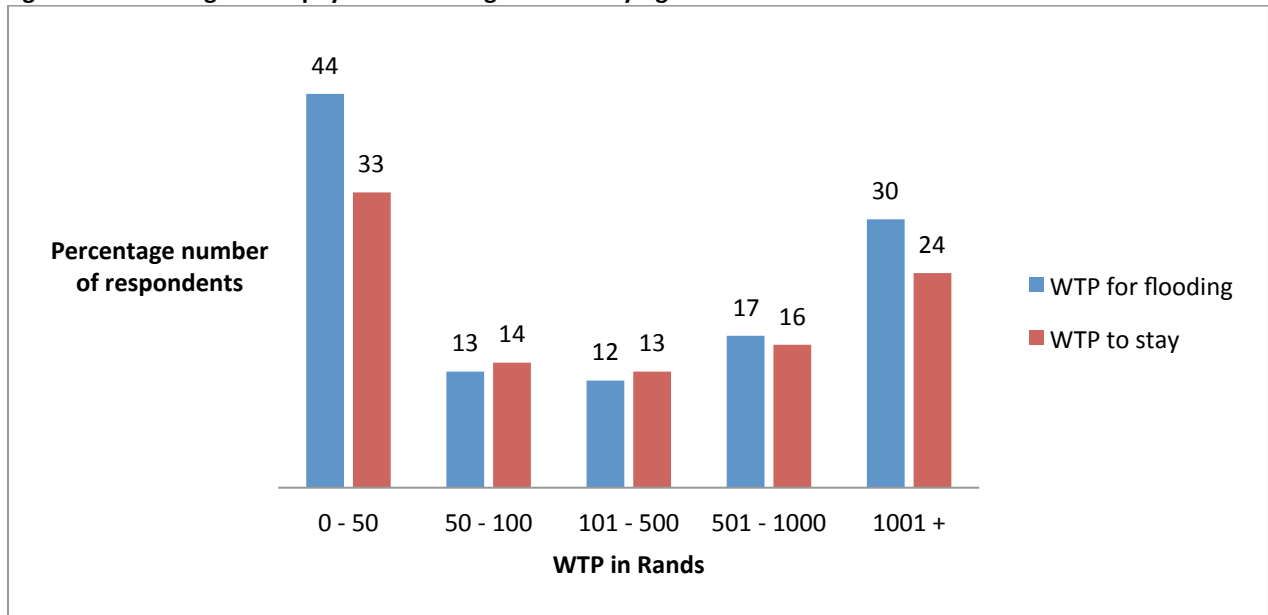
5.3.3 Area of preference in terms of flooding

This question was aimed at testing the respondents' psychological dispositions towards living in areas plagued with minor flooding every year such as informal settlements by comparing it to an area that is designated to have a substantial flood only once every ten years. According to literature, informal settlements experience flooding every year due to roof leakages in poorly constructed dwellings, as well as by living in areas designated as ponds that are prone to flooding. The results obtained showed that 65% of the respondents preferred to live in areas designated to have minor flooding every year while 35% preferred one major flooding experience every decade. In other words, minor flooding every year is not a major concern for more than half the respondents. It is tolerable.

5.3.4 Willingness to pay

The respondents were then further asked how much they were willing to pay to continue living in their present circumstances and how much they were willing to pay to relocate to another area free from floods.

Figure 5.13: Willingness to pay for relocating and for staying in the area



Almost half the respondents (44%), were willing to pay nothing to minimal amounts of money to solve flood related issues in their areas while approximately a third of them, 33% are also willing to pay nothing to minimal amounts to continue living where they are living. At the same time, 30% of the people are willing to pay a lot of money to solve flooding issues in their area, and a corresponding 24% will pay a lot of money in order to stay where they are living today. A close inspection at the graph yields that, slightly more than half the population are not willing to pay a lot to stay where they are living and to solve flooding issues, while a little less than half will pay more to solve flooding issues and to continue living in the area. This raises issues such as the concept of home versus house, issues of priorities as well as perceptions of seriousness.

5.3.5 Framing effects

In question 21 respondents were asked to choose between two risk communication programs with similar net outcomes to test for the effects of framing using the prospect theory. The only difference lies in the way they were framed. Option one had 37 responses while option two had 73 responses. This means 73% of the respondents preferred program two to program one, meaning the respondents viewed the two programs to be different merely because of the way they were framed. Program one is framed in the negative with 300 potential deaths while program two is framed in the positive with two

thirds of 900 being saved. Obviously, framing led to errors in judgement on the part of the respondents, a critical issue in risk communication.

5.4 Evaluation of current flood risk communication

This section aims to answer the research question: *Based on community perceptions how effective are the current flood risk communication efforts of the City of Cape Town?* A number of questions have been designed to evaluate the current flood risk communication in Philippi including questions 9, 10, 12, 13, 14, which measure success indirectly, and 16, which is a more direct evaluation. Question 9, with reference to the perception of seriousness marks the progress of risk communication to date. If the risk communication programs were successful, they should have been able to change the perceptions of the respondents with regards to flooding. Section 5.2.1.1 shows the results for perception of seriousness. 60% of the respondents regarded flooding to be a serious issue. Question 10 evaluates the most common sources of flooding information. It is assumed that the most prominent source should be the City of Cape Town because it is the main body governing flood risk. Although it uses other sources including posters, radio and the Internet, the percentage usage of these sources by the residents are very low (figure 5.8). Ultimately, other social entities are more effective in filtering flood risk information, including family oriented organisations such as schools and churches. Evidence also shows that, these entities are more trusted than the risk management body itself (figure 5.7).

Questions 12 and 13 were aimed at measuring the knowledge levels of the respondents in terms of flood risk communication. This will be a direct reflection of the effectiveness of the City of Cape Town in imparting knowledge to people living in informal settlements. As the results show, for question 12, a lot of respondents are well versed with causes and consequences (46% respectively) of flooding in their areas but however, the knowledge base when it comes to recommendations on how to deal with floods was very poor (see figure 5.11). Question 13 explored the knowledge base even further by asking the respondents about flood prevention methods. According to literature, there are common risk communication recommendations that the City of Cape Town gives to residents that are cheap to implement such as the use of sandbags to elevate floors of shacks, digging trenches for runoff, relocating to higher ground and clearing storm drains. These were some of the responses that the

question was looking for. A total of 97 associations were given, giving a response rate of 17%, which was very poor. According to the judges, four domains were applicable as follows:

- Relationships.
- Definitions.
- Do not know.
- Flood Management and Prevention Methods (FMPM).

Figure 5.14: Flood prevention domain frequencies

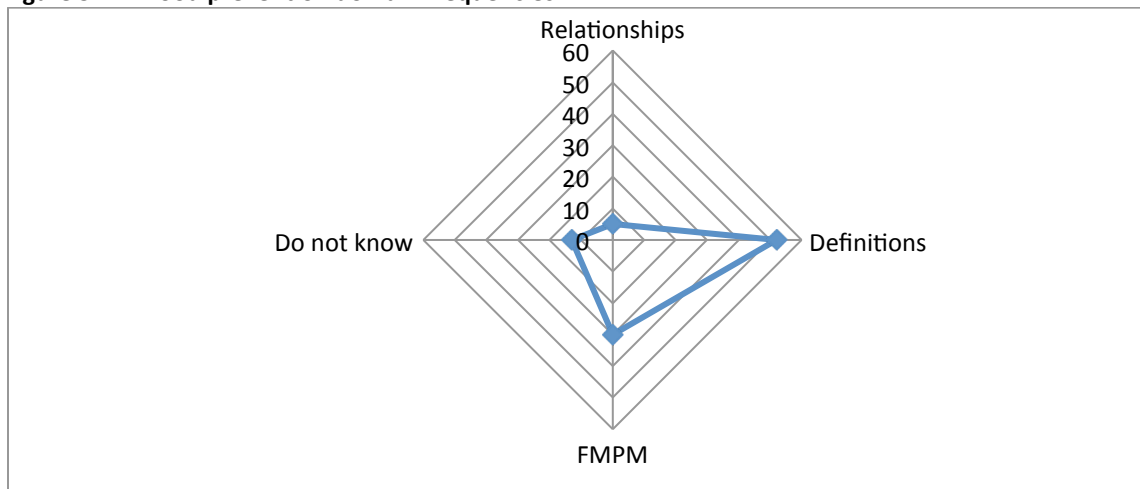
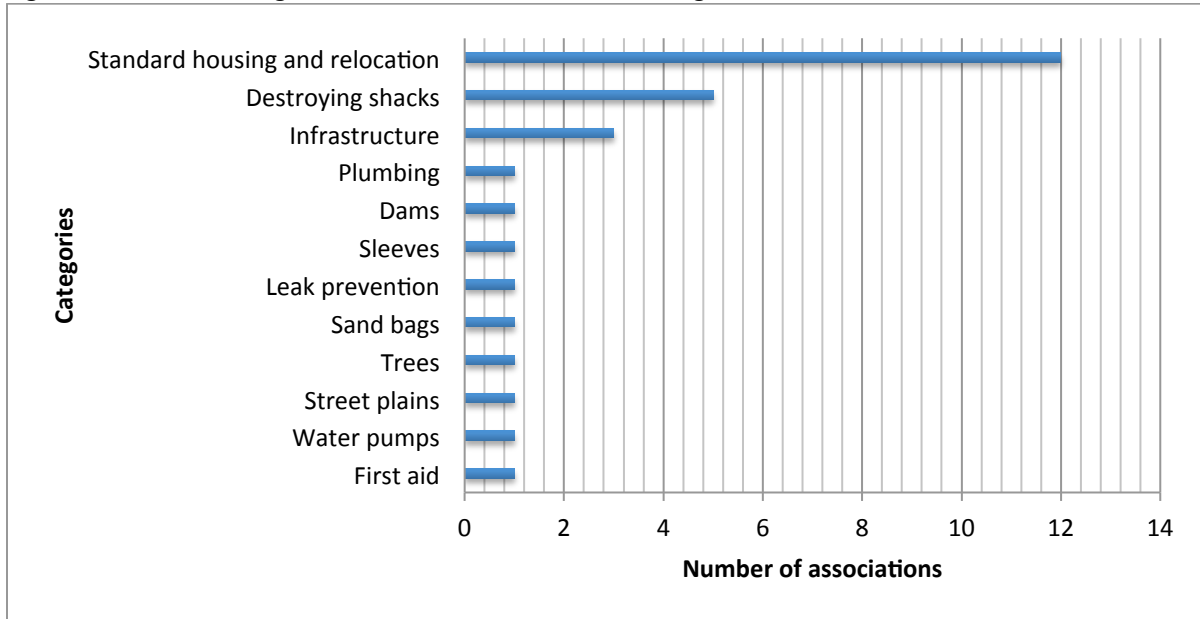


Figure 5.14 above shows that, consistent with question 12, 50 out of 97 (52%) of the associations are definition based and this domain had the highest number of associations compared to the other three. Because the gist of the question lay in measuring the knowledge base of flood prevention methods, the most applicable domain was considered to be the FMPM, 29 (30%) of the total number of associations lay in this domain. An approximate 13 out of 97 (13%) of the associations claimed not to know anything while 5 out of 97 (5%) of the associations were relationship based. Although the question’s focal point was not in relationships, it is quiet important to note that the respondents associated the City of Cape Town with flood prevention as per the relationship domain, although at the same time, the frequency of associations was very low. Figure 5.15 below shows a breakdown of the associations obtained in the FMPM. Most responses were associated with standard housing and relocation along with the destruction of shacks. The majority of responses however, were once off and did not recur; this is to say each particular association was mentioned once, except for infrastructure, which was mentioned three times. It is also notable that other particular associations such as leak prevention and plumbing are highly related to housing issues while building dams can be synonymous to infrastructure. Therefore,

housing issues and relocation dominated flood prevention solutions followed by infrastructural interventions.

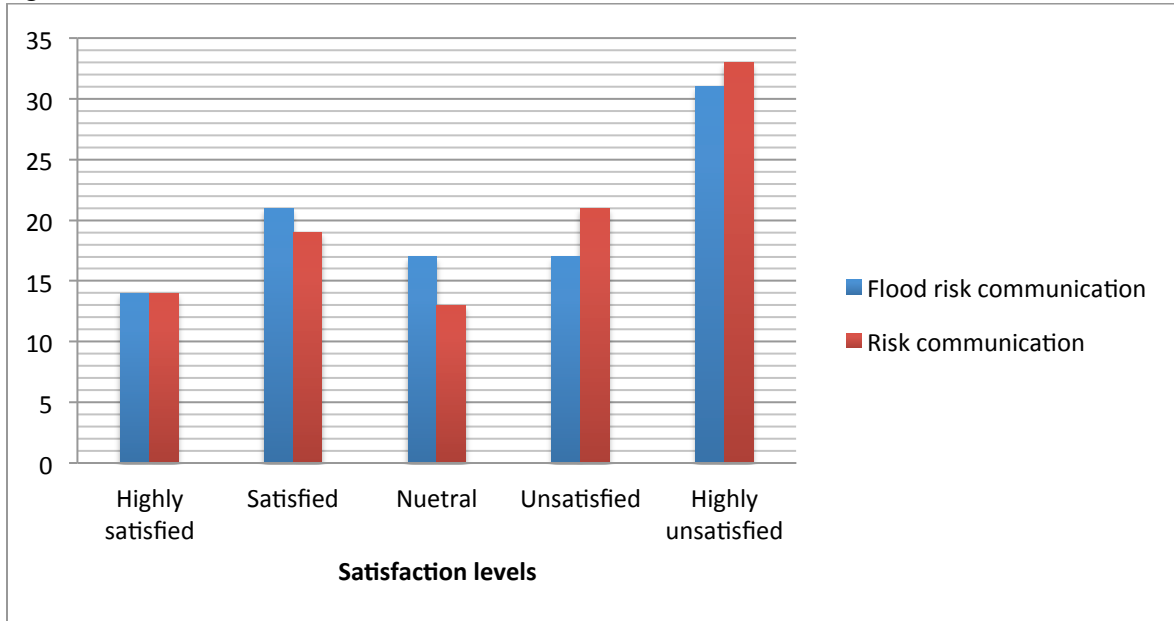
Figure 5.15: Flood Management and Prevention Methods categories



Questions 16 and 17 were more direct and aimed to measure respondent satisfaction levels with risk communication. Because this research was aimed at evaluating flood risk communication and also to measure psychological dispositions, the questions were designed so as to be comparative. Figure 5.16 shows the results obtained from the questionnaire. Both graphs show similar tendencies with fewer respondents being satisfied and highly satisfied with both flood risk and risk communication in their areas at 33% and 35% respectively. Approximately, half the respondents were unsatisfied to highly unsatisfied with flood risk and risk communication in their areas at 54% and 48% respectively. The majority of the respondents that showed negativity towards flood risk and risk communication were highly unsatisfied and constituted approximately a third each of the total population. The rest of the respondents claimed to be neutral at 17% and 13%. Hence, the majority of respondents showed a higher degree of negativity towards the effectiveness of flood risk and risk communication. Comparing the two graphs it is also quiet apparent that slightly more people were unsatisfied and highly unsatisfied with flood risk communication compared to risk communication in general. Also, slightly more respondents were satisfied and highly satisfied with risk communication in general compared to flood risk

communication. Therefore, people are more satisfied with other risk communications compared to flood risk communication.

Figure 5.16: Risk communication versus flood risk communication effectiveness



CHAPTER SIX

The main purpose of this study has been to evaluate flood risk communication by, firstly proposing a model that reflects how residents of informal settlements evaluate risk communication, then secondly, verify this evaluative model on a case study population, and last but not least, make an evaluative assessment of the current flood risk communication. This chapter aims to answer the research questions based on the empirical results and analysis of the previous chapter. The findings will be discussed and recommendations made for future improvements in this field of study.

6.1 Research question 1: To create a flood risk communication model (FRCM) that describes the interrelationship between flood risk communication efforts and flood risk perception and behavioural patterns of Cape Town's high flood risk informal settlements.

Figure 1.1 shows the proposed FRCM based on a thorough literature review. The model is multi-theoretical and encompasses various field backgrounds, including social theories, economic theories and psychological theories on a background of environmental influences. This allows it to be holistic in nature, as all these factors have been proven to influence day to day human behaviour. Psychological theories basically followed the mental models approach where the main argument lies in getting to know your communication recipients. However, it slightly differs in that; the FRCM considers lay dispositions as the objective perceptions and the basis upon which risk communications can be evaluated. If the deficit model is to be followed, the deficiency will be on the part of the expert, while the mental models of the lay form a platform upon which the experts can learn from. This is the opposite of a traditional mental models approach. Although expert opinion is said to be objective and based on scientific evidence, it is often the person on the ground that experiences the actual risk, and therefore, is at a better position to evaluate the risk based on contextual issues such as environmental, social and economic influences. A good example would be climate change. There is a lot of scientific evidence that links changes in the physical environment with a changing climate for periods dating as far back as millions of years. It is also known that the use of substances with greenhouse gases plays a major role in this changing climate. Experts come up with solutions as to the best way this climate change can be combated based on this science. On the other hand, the lay person on the ground is

unaware of all the scientific evidence but can feel the changes in situ, and over a period of time, he/she gradually adapts based on not only experience, but also a range of other contextual issues that the expert fails to take account of in his solutions for tackling the issue. As such, the person on the ground is in a better position to understand the problem holistically, and has indigenous knowledge pertaining to the risk. This is a basis upon which the expert can learn from and formulate his solutions based on not only science, but also what the community knows and values. Risk communication should therefore foster the values of the community.

When the influence of contextual issues is brought forth, one cannot do away with issues of decision making especially in developing worlds where contexts determine the hierarchies of decision making. Decision-making theories have mostly been based on economics with normative models and interlinked with psychology in bounded rationality. The FRCM sought to prove that risk communication signals could be impacted by social, economic and environmental contexts. For a risk communication message to pass through this sieving mechanism and be able to influence perceptions on flood risk, it has to be at par with the values of the community it is being transmitted in. In this case it has to be able to cater for the recipient's status quo, risk propensity, social attachments including attachments to the risk communication institution together with cultural history. Recipients are therefore viewed as organisms that constantly evolve and adapt to a given situation and environment. The process of adaptation includes a hierarchy of mechanism brought forth from that particular context. The role of the expert is to come up with solutions that are best suited to the community's values and are better able to appeal to the present contexts. Although, Kahneman and Tversky prove that judgements are prone to error by way of heuristics, the FRCM proves those cognitive errors in flood risk serves to be representative of what the community values the most. For instance, the refusal to move from a high risk flood prone area to another area which is obviously regarded as better by the expert, although an observer can see it as an act of idiocy, in actual fact, it represents values interrelated to contextual issues such as financial situations, poverty, a sense of belonging as well as other issues of adaptation that includes perceptions of flood threshold, perceptions of frequencies etc. An individual might be willing to endure annual flooding because the cost of being flooded say, three months of the year outweigh the cost of moving to another area which is flood free but may be very far from the work place and may therefore be expensive in terms of time taken to travel and transportation costs. In essence the individual has evaluated not only flooding as a risk and stand-alone factor, but in conjunction with other contextual influences. The observer views this as abnormal behaviour, but in actual terms, the individual has rather

evaluated the cost of adapting to annual flooding versus the cost of moving to an area where access to work becomes negatively impacted. The role of the expert should be seen by the lay as having the same values. According to this research, the role of the risk communication should be to present other innovative ways that can help the lay person to adapt further to the situation as opposed to solutions that go off a tangent.

6.2 Research question 2: To verify the relevance of the model on a selected community as a case study

This research question was divided into three sections testing for the relevance of past experiences and social networks as well as psychological factors to determine the priorities and values of the community.

6.2.1 The role of past experiences

Past experiences encompassed prior exposure to flooding, flood damages, perception of seriousness and the decision to relocate. The results showed an association between prior flooding exposure, perception of seriousness, past flood damages and the decision to relocate. There are greater tendencies for individuals who have lost property due to flooding and who have had prior flooding exposures to consider relocating as compared to those that have not. Thus, past experiences do play a moderating role to risk communication. This, as mentioned before, is related to loss aversion. According to demographics of the respondents, almost half the population lives in substandard housing while a little over half live in brick houses, it can be assumed that the population that lives in brick houses experiences less flooding than their counterparts. As a result, although they probably haven't experienced flood damages, they are still risk averse and therefore perceive flooding as a serious problem based on the reference point. On the other hand past flood damages and the decision to relocate would be associated because it is based on actual experiences. Risk aversion and reference point therefore lead to a high perception of seriousness. On overall, past experiences can be seen to play a significant role in the decision to relocate and can be said to have a filtering and moderating influence on risk communication.

This research shows that past experiences are important in shaping perceptions and can influence risk communication. This factor is very important when designing flood risk communication and institutions should aim to analyse community past experiences prior to the communication. Of note are frequencies and thresholds. Related to this was question 18 where respondents were asked to choose between an area that experiences minor flooding annually and one that experiences flooding once every ten years but at a greater scale. More than half the respondents chose to experience minor flooding annually. This brings forth two main points; firstly, because people are loss averse, they prefer living in area where flooding is minor and leads to minimal losses as compared to an area where the risk can be seldom encountered but can lead to devastating losses. Secondly, annual flooding is similar to the current situation in informal settlements due to sub-standard housing. The threshold is simply not high enough for it to become a priority in terms of contextual hierarchies. This is to say, other contextual influences outweigh the cost of relocating.

6.2.2 The role of social networks

Social networks play a significant role in the dissemination of information and are important in risk communication. Social networks can either amplify the existence of danger or they can temper it down. The relevance of social networks was measured using sources of information and responses to the theme of trust. On both counts, the results show a tendency for the majority of the respondents to lean towards friends and family. Other significant sources of influence included churches and teachers. This leads to the conclusion that friends, family and other family based organisations have the greatest influence in filtering flood risk communication, a factor we attribute to trust. Teachers and churches as well as other organisations not affiliated with political and governmental institutions represent pillars of trust in communities. This is especially true for informal settlements riddled with problems such as housing, employment, health etc. The solution to all issues are integrated, for instance, flooding issues can be solved through better housing, the problem of substandard housing requires better housing, health issues require better sanitation facilities through better housing. Because these problems have almost similar solutions and are all mandated by the government, and therefore include political associations, any institution that is seen as being affiliated with the governing body has a high probability of being classified under one bracket. This is in accordance to judgemental heuristics by Kahneman and Tversky. If the governing body is seen as trustworthy, all its operational arms are

perceived as worthy of being trusted. Because of the negative contextual influences in informal settlements and the negative history associated with apartheid, governing bodies are likely to be perceived negatively. This explains why the City of Cape Town is not nominated as the major source of flood risk information even though it is the main risk governing body in the area. Furthermore, sources of flood risk information used by the City of Cape Town to create awareness are not very popular. Sources should be family and entertainment orientated such as television and radio because most social networks are family based and radios and televisions are family activities. Risk communication messages can therefore be constrained by issues of trust and the social networks. It becomes advisable to use family orientated networks as risk communication agents. The issue of integrated management also needs to be addressed and improved.

6.2.3 Community priorities

Measuring psychological dispositions and priorities became essential after realising that residents of informal settlements do not conform to the normative model of decision making. The results show that most respondents consider flooding to be a serious problem, they are well aware of what can be considered to be a risk, its consequences and the different forms of risk. They can define flooding, its causes and its consequences. However, the results also tell us that the residents perceive other risks such as crime, drugs, accidents, gangsters and theft to be much more dangerous compared to natural risks such as flooding and extreme weather events. This is especially true in informal settlements where crime and drugs are dominant and lead to deaths on a daily basis, while floods and natural disasters occur seasonally and are a lot easier to control. In other words, flooding, as a risk does not take precedence when compared to other risk factors. In terms of hierarchy, if residents can be tolerant to what they perceive as high risk factors (through living in high crime risk informal settlements), how much more can they be tolerant to flooding as a risk? Automatically, we can conclude: the cost of leaving informal settlements with high risk factors outweighs the cost of staying. This takes us back to contextual hierarchies, priorities and values. A step further, respondents were also asked to rate from a list of priorities what they consider to be the most important and the least important. Results showed employment and housing followed by flooding are the most important as first options, and as second options, housing, water and sanitation, then employment. These problems in informal settlements are considered to be far more important than flooding. As long as residents are unemployed, lack proper

housing, they will always consider adapting to floods as a better solution. This goes hand in hand with the preference to stay in an area with minor flooding annually.

Willingness to pay was also another psychological question to test dispositions. Firstly, respondents had to choose how much they are willing to pay to continue living where they are currently living and secondly how much they are willing to pay to solve flooding issues in their areas. About a third of the respondents are willing to pay a lot to solve flooding issues and to also continue living where they are living. The rest of the respondents are willing to pay minimal amounts. This can be explained in terms of priorities. Clearly, other contextual issues play a greater role compared to flooding issues. If flooding was a top priority, respondents would have been willing to pay more to solve flooding issues and pay more as well to continue living where they are living. This implies a question of needs not wants. A lot of residents in informal settlements come from the Eastern Cape to look for jobs and cannot afford living in better areas because of unemployment and low incomes. Flooding therefore, is not a priority. A risk communication at this time will not be successful in motivating residents to resettle because there are needs far greater than flooding. Rather, for risk communication to be successful, it needs to address adaptation measures and to carry on a more integrated approach.

6.3 Research question 3: To evaluate people's perceptions of current flood risk communication efforts of the City of Cape Town.

Current flood risk communication was evaluated in terms of knowledge levels of the respondents and more directly by measuring satisfaction levels. The results ascertain that, respondents are very much aware of flooding as a problem, its causes and consequences but however, knowledge is limited on the approaches to mitigating flooding problems. When it comes to mitigation, the most popular responses are solving housing issues and getting rid of shacks, which technically speaking requires input and assistance from authorities. Cheap, adaptive and self-motivated responses such as using sandbags and digging trenches had very poor responses. Under such contextual influences, residents should typically be made more aware of cheaper methods of flood mitigation and issues of adaptation. This is an environment where people are unemployed and below the poverty datum line, it should therefore make more sense to teach people simple and cheaper methods of combating flooding. In terms of flood risk awareness, the current flood risk management strategy has been influential but in terms of

combating and mitigating the issue, attempts have been quiet unsuccessful. Housing issues and the eradication of substandard housing typically means resource injection and places a dependency on institutional facilities, which tend to be scarce. Because housing issues, sanitation, flooding are all interrelated, it is viewed as the government's mandate to reduce flood risk and not a personal responsibility. Typically flood risk communication has been unsuccessful in combating these perceptions. This dependency is clearly shown in satisfaction levels where the greater majority are either unsatisfied or highly unsatisfied with flood risk communication and risk communication in general. Of note is the almost negligible difference between risk communication and flood risk communication. According to heuristics and biases, people tend to group similar events together. This means flood risk communication is not evaluated as a standalone but rather in conjunction with other risk communications that are associated with the same parent organisations. Risks are also grouped together, which is why the responses to both questions are almost the same.

6.5 Conclusion

One of the more certain aspects in this research is the vast gap between the expert and the lay as well as the complexity of evaluating flood risk communication. And, one of the more important points to note is the astronomical amount of data that can be generated using the FRCM to cater for these differences. Care should however, be taken in distinguishing between psychological probabilistic tendencies, quantitative measures as well as the main purpose of the FRCM. In terms of purpose, each risk communication needs to be designed according to its goals and purpose, for example a goal that aims to improve the risk communication format and one that aims to verify the main sources of risk communication information would be different. For example in this research, figure 5.9 refers to sources of risk communication formats as opposed to who provides the information. Care should indeed be taken with regards to the purpose of the research.

In terms of measurements, the FRCM is a guide or framework that points towards the direction in which public opinions lie. It is a measure of psychological dispositions, and mainly generates propensities and trends. This makes it very useful in the communication of risk especially with regards to natural risks that cannot be fully quantified. While the FRCM tries to be as holistic as possible in mimicking social and

economic filters that play a significant role in how flood risk communication is evaluated by the lay, it still represents only a segment of the real life situation and issues that impact communication evaluation on the ground. As such, quantitative data can also be collected and used in conjunction with the FRCM. The FRCM has a high *explanatory* power compared to quantitative measures. Results obtained can be verified by the use of national and local statistics and observation. For instance, in the case study area presented in this research the model serves to *explain why* residents are being *observed* to populate high flood risk zones and why risk communication has been considered to be a failure. Probabilities support concrete evidence.

Another advantage of the FRCM is the exorbitant amount of data that can be collected. For instance, WTP although in this study, it is used mainly as a point of comparison, can yield a lot of data if compared to other statistics such as income, housing type, education, age, home ownership etc. Other measurements could also include analysis of whether risk communication should target a particular age group or not. Hence, a lot of data can be generated using the FRCM.

This research asserts that the first step before the design and commencement of a risk communication is to ascertain the size of the gap between experts and lay by getting to know the community. The FRCM provides an explanation for this gap. Once one gets to know the community, including the social, economic and environmental contexts that can influence flood risk decision-making, only then can the risk communication be designed. Constant evaluation of the effectiveness of communication is mandatory and should always be based on community perceptions. A look at integrated risk management in informal settlements is also worth considering especially in the face of their contexts. Risk communication is a topic that needs to be accorded its place in reducing risk especially in the case of Cape Town informal settlements where contextual influences are very significant and can determine life or death situations.

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Appendix A

Questionnaire for Residents of the Community

Please answer the following questions. Tick the answer that most applies to you.

Area of Residence _____

1. What type of house do you live in?

| | |
|---------------------------------|---|
| Informal dwelling (shack) | 1 |
| RDP brick-house | 2 |
| Flat in a block of flats | 3 |
| Others please specify: | 4 |

1

2. What is your gender? Please tick

| | |
|--------|---|
| Male | 1 |
| Female | 2 |

2

3. What age category do you belong to?

| | |
|--------------|---|
| Below 20 | 1 |
| 21 – 30 | 2 |
| 31 – 40 | 3 |
| 41 – 50 | 4 |
| 51 and above | 5 |

3

4. With which population group do you associate yourself with most?

| | |
|--------------------------------|---|
| Black | 1 |
| White | 2 |
| Coloured | 3 |
| Indian | 4 |
| Other please specify: | 5 |

4

5. What is your highest educational qualification?

| | |
|---|---|
| No formal education | 1 |
| Completed primary education (Grade 7 and below) | 2 |
| Secondary education (Grade 8-11) | 3 |
| Matric (Grade 12) | 4 |
| Matric plus diploma/degree | 5 |
| Others please specify | 6 |

5

6. Current occupation?

| | |
|--------------------------------|---|
| Unemployed | 1 |
| Self employed | 2 |
| Government service | 3 |
| Private sector | 4 |
| Other please specify: | 5 |

6

7. What is your monthly income?

| | |
|-----------------|---|
| R2000 and below | 1 |
|-----------------|---|

| | |
|-----------------|---|
| R2001-R4000 | 2 |
| R4001-R6000 | 3 |
| R6001 and above | 4 |

7

8. Are you the owner of your house or are you a tenant?

| | |
|----------------------------|---|
| Owner | 1 |
| Tenant | 2 |
| Other please specify | 3 |

8

22. Please tick either 'yes' or 'no' to the following questions:

| Questions | Yes | No |
|---|-----|----|
| Have you ever experienced flooding in your home? | 1 | 2 |
| Do you think flooding is a serious problem in your area? | 1 | 2 |
| Have you ever lost property due to flood damages? | 1 | 2 |
| Have you ever considered relocating to another area free from floods? | 1 | 2 |

9
10
11
12

22. Where do you get most of your flood related information from? Please tick and specify.

| Information source | Yes | No |
|--|-----|----|
| Municipality City of Cape Town Awareness campaigns | 1 | 2 |
| Friends | 1 | 2 |
| Family | 1 | 2 |
| Church | 1 | 2 |
| Posters | 1 | 2 |
| TV news channel: If yes, specify | 1 | 2 |
| Radio If yes, specify | 1 | 2 |
| Internet websites If yes, specify | 1 | 2 |
| Other social networks If yes, specify | 1 | 2 |

13
14
15
16
17
18 19
20 21
22 23
24 25

11. Think of the word 'RISK' what is the first thing that comes to your mind? Write down what you think of first? Use single words or phrases, avoid long sentences. Write down as many responses as you can in the order in which they come to mind.

.....
 And what else?.....
 And what else?.....
 And what else?.....
 And what else?.....
 And what else?.....

26
27
28
29
30
31

12. Think of the word 'FLOOD' what is the first thing that comes to your mind? Write down what you think of first? Use single words or phrases, avoid long sentences. Write down as many responses as you can in the order in which they come to mind.

.....
 And what else?.....
 And what else?.....

32
33
34

And what else?.....
 And what else?.....
 And what else?.....

35
 36
 37

13. Think of the word '**FLOOD PREVENTION**' what is the first thing that comes to your mind?
 Write down what you think of first? Use single words or phrases, avoid long sentences.
 Write down as many responses as you can in the order in which they come to mind.

.....
 And what else?.....
 And what else?.....
 And what else?.....
 And what else?.....
 And what else?.....

38
 39
 40
 41
 42
 43

14. Think of the word '**TRUST**' what is the first thing that comes to your mind?
 Write down what you think of first? Use single words or phrases, avoid long sentences.
 Write down as many responses as you can in the order in which they come to mind.

.....
 And what else?.....
 And what else?.....
 And what else?.....
 And what else?.....
 And what else?.....

44
 45
 46
 47
 48
 49

15. What problems do you think the government should solve first in your area? Write
 down a number against each problem, with number 1 being the most important problem
 that needs to be solved and number 6 being the least important.

| Problems | | Answer |
|-------------------------------|-------|--------|
| Provision of standard housing | | |
| Water and sanitation | | |
| Flooding | | |
| Employment | | |
| Infrastructure | | |
| Other please specify | | |

50
 51
 52
 53
 54
 55

22. Using the scale below, how satisfied are you with the current flood risk communication in
 your area

| | |
|--------------------|---|
| Highly satisfied | 1 |
| Satisfied | 2 |
| Neutral | 3 |
| Unsatisfied | 4 |
| Highly unsatisfied | 5 |

56

22. Using the scale below, how satisfied are you with the current risk communication in your area

| | |
|--------------------|---|
| Highly satisfied | 1 |
| Satisfied | 2 |
| Neutral | 3 |
| Unsatisfied | 4 |
| Highly unsatisfied | 5 |

57

18. Which area would you prefer to live in?

| | |
|---|---|
| An area that is predicted to have a major flood once every 10 years | 1 |
| An area that is predicted to have minor flooding every year | 2 |

58

19. How much are you willing to pay in Rands (ZAR) to solve flooding issues in your area today?

| | |
|--------------|---|
| R0 – R50 | 1 |
| R51 – R100 | 2 |
| R101 – R500 | 3 |
| R500 – R1000 | 4 |
| R1001+ | 5 |

59

20. How much are you willing to pay in Rands (ZAR) to continue living where you are living today?

| | |
|--------------|---|
| R0 – R50 | 1 |
| R51 – R100 | 2 |
| R101 – R500 | 3 |
| R500 – R1000 | 4 |
| R1001+ | 5 |

60

21. In a settlement that has a population of 900 residents, in order to save lives, which flood risk reduction programme do you consider better?

| | |
|--|---|
| A programme that saves approximately 600 residents, but has a potential of doing harm to 300 residents; | 1 |
| A programme that has a two third chance that 900 residents will be saved and a one third chance that no one will be saved. | 2 |

61

22. According to your personal flooding experience, can you predict whether flooding will occur in your area in the next 3 to 4 years.

| Year | flooding | No flooding |
|------|----------|-------------|
| 2012 | 1 | 2 |
| 2013 | 1 | 2 |
| 2014 | 1 | 2 |
| 2015 | 1 | 2 |

62

63

64

65

Appendix B: AGA Answers

Risk = 367 Responses

| Applications (218) | Consequences (97) | Definitions (4) | Causes (48) |
|---------------------------|--------------------------|---|---------------------------------|
| Drunken driving(7) | Loss(13) | Something that affects people and needs to be resolved(1) | Poverty(3) |
| Floods(5) | death(27) | Something that impacts adversely on people(1) | Population increase(1) |
| Crime(49) | Injuries(12) | Something that you do without considering the results(1) | Lack of education(4) |
| Robbery(18) | Damages(17) | concerns(1) | Sicknesses(3) |
| Theft(37) | Loss of property(15) | | People's lives(2) |
| Hijacking(12) | Drowning(7) | | Unprotected sex(11) |
| gangsters(18) | Water blockages(1) | | children(2) |
| Fires(5) | Painful(1) | | Living in a shack(11) |
| Drugs(30) | scared(1) | | Walking in the streets late(3) |
| Heavy rains(7) | Win (3) | | The residential area(1) |
| Toxic chemicals(1) | | | Walking to the train station(1) |
| Weather conditions(1) | | | Short cuts(1) |
| accidents(28) | | | No street lights(1) |
| | | | Location(2) |
| | | | Greediness(2) |

Floods=157 Responses.

| Causes (76) | Consequences (76) | Recommendations (6) | Other (7) |
|----------------------|--------------------------|----------------------------|--------------------------|
| Water(49) | Loss of property(31) | Precaution(1) | Do not know(3) |
| Rain (14) | Damages(8) | Building dam walls(1) | A lot of things(1) |
| Global warming(1) | Injuries(8) | Safety(3) | Nothing comes to mind(3) |
| Bad weather(3) | Car accidents(1) | shacks(1) | |
| tornado(2) | Danger(4) | | |
| Hurricane(1) | Drowning(1) | | |
| Drainage problems(1) | Death(9) | | |
| Chemicals(4) | Financial loss(1) | | |
| Over population(1) | Diseases(3) | | |
| | Disaster(5) | | |
| | Hazard(2) | | |
| | risk(1) | | |
| | Painful(1) | | |
| | fear(1) | | |

Flood prevention = 97 Responses.

| Management methods(29) | Do not know (13) | Relationships(5) | Definitions (50) |
|-------------------------------|--------------------------|-------------------------|-----------------------------|
| Fixing plumbing(1) | Do not know(8) | City of cape town(5) | Improvement(1) |
| Building dam walls(1) | Nothing comes to mind(5) | | Saving lives(1) |
| Flood sleeves(1) | | | Relocation(3) |
| Leakage prevention(1) | | | Safety(19) |
| Change of infrastructure(3) | | | Less floods(5) |
| Sand bags(1) | | | Ways to mitigate floods(12) |
| Planting trees(1) | | | Emergency plan(6) |
| Street plains(1) | | | Warnings(1) |

| | | | |
|--|--|--|------------------------|
| Water pumps(1) | | | Risk management(1) |
| Getting rid of shacks(5) | | | Sickness prevention(1) |
| Provision of standard housing in a suitable area(12) | | | |
| First aid(1) | | | |

Trust = 410 Responses.

| Relationships (179) | Sentiment (98) | Application (50) | Definition (26) | Other (57) |
|----------------------------|-----------------------|-------------------------|------------------------|-------------------|
| Friends(54) | Hope(5) | Vote(1) | Something big(2) | Nothing(7) |
| Family(34) | Honesty(49) | freedom(4) | Responsibility(6) | Do not know(26) |
| Teachers(31) | Belief(5) | Condom(15) | Safety(3) | Sick(1) |
| Wife(8) | Faithful(5) | Authority(1) | relationship(1) | Things(1) |
| Boyfriend(5) | Kind(1) | Groups (1) | check(1) | No one(9) |
| Local government(4) | Reliable(6) | Work(2) | Reliable(3) | Who(6) |
| municipality(8) | Loyalty(1) | Jobs(3) | Strong(3) | |
| God(26) | Patience(1) | Home(4) | True (3) | |
| Red cross (6) | trustworthy(8) | Residential area(7) | Love(4) | |
| Church (3) | Happy(1) | Relocation(3) | | |
| | Love(5) | Sex(7) | | |
| | Sincere(4) | Hood(2) | | |
| | disappointment(5) | | | |
| | Comfortable(1) | | | |
| | relax(1) | | | |

APPENDIX C: 2011 census statistics for Philippi by ward

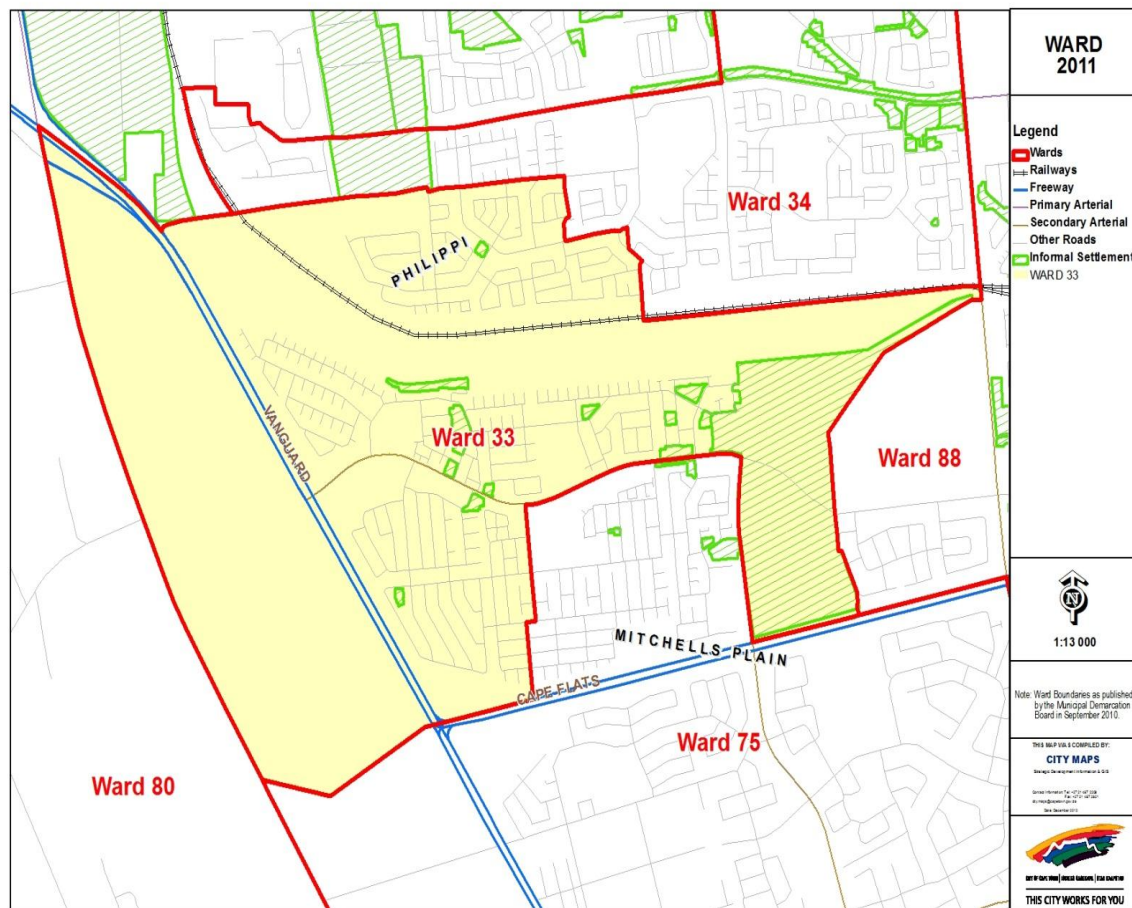
City of Cape Town – 2011 Census – Ward 033

Compiled by Strategic Development Information and GIS Department, City of Cape Town 2011 and 2001 Census data supplied by Statistics South Africa (Based on information available at the time of compilation as released by Statistics South Africa)

[Ward Overview](#), [Demographic Profile](#), [Economic Profile](#), [Household Services Profile](#) Ward Description

Ward 033 includes the areas of Cossovo, Philippi, Samora Machel and Weltevreden Valley.

January 2013



City of Cape Town – 2011 Census – Ward 034

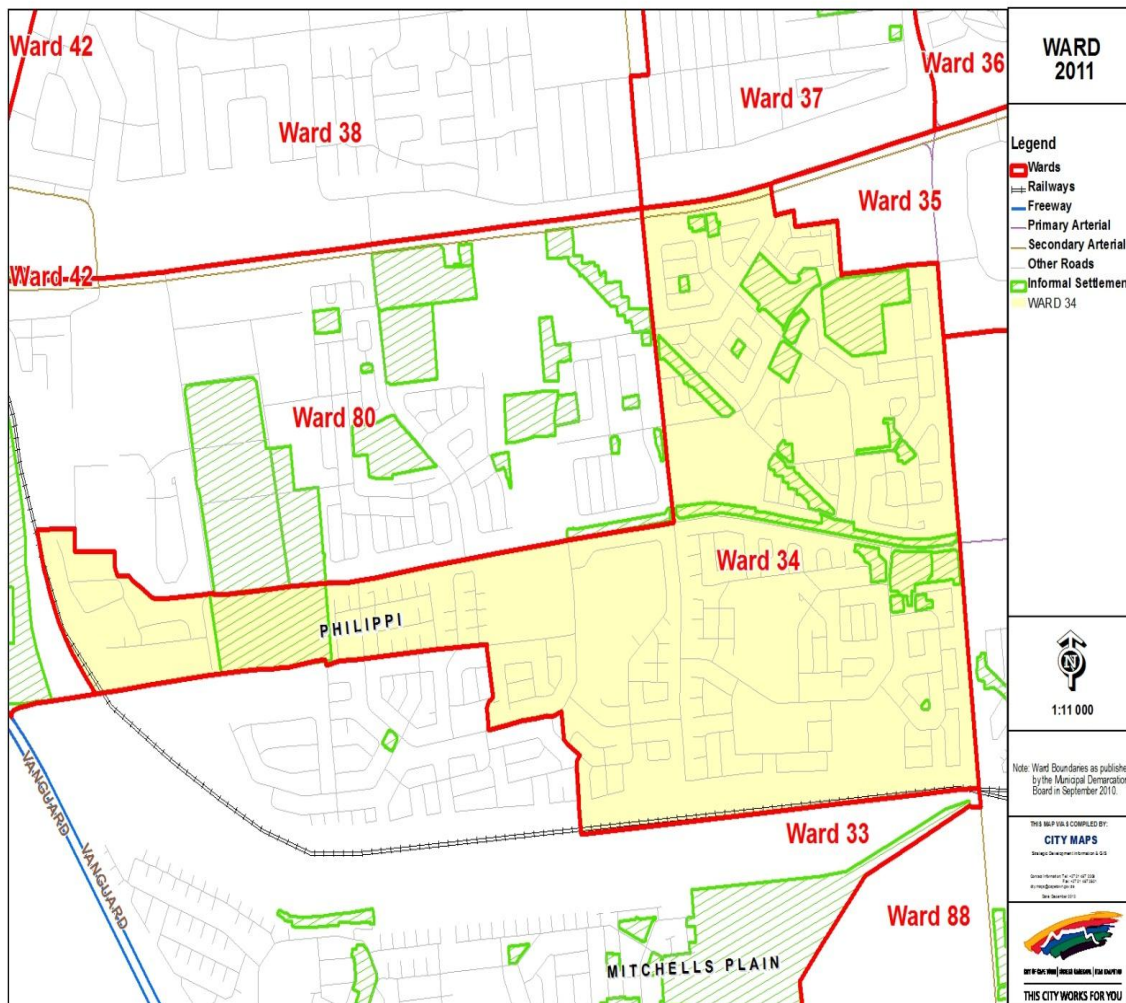
Compiled by Strategic Development Information and GIS Department, City of Cape Town 2011 and 2001 Census data supplied by Statistics South Africa (Based on information available at the time of compilation as released by Statistics South Africa)

[Ward Overview](#), [Demographic Profile](#), [Economic Profile](#), [Household Services Profile](#)

Ward Description

Ward 034 includes the areas of Philippi.

January 2013



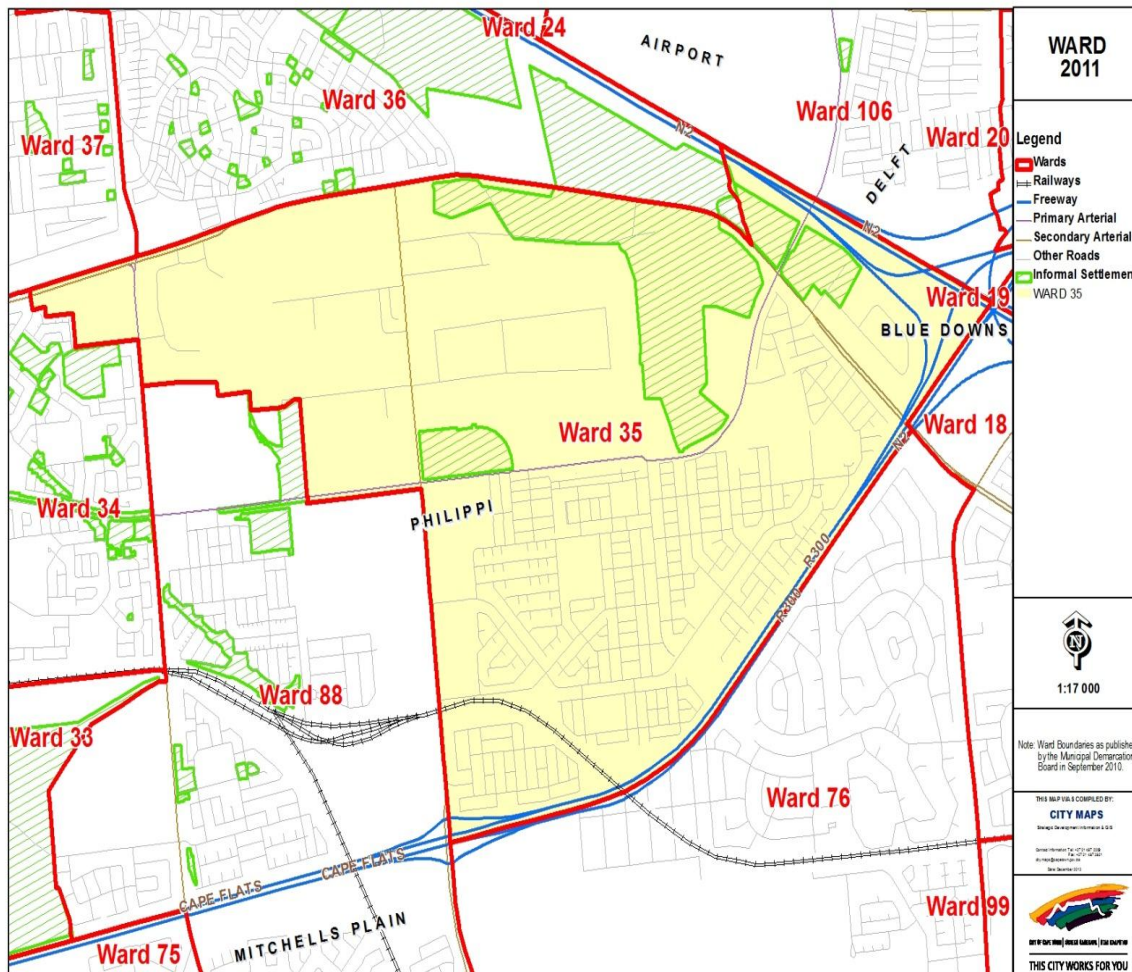
City of Cape Town – 2011 Census – Ward 035

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[Ward Overview](#), [Demographic Profile](#), [Economic Profile](#), [Household Services Profile](#) Ward Description

Ward 035 includes the areas of Klipfontein, Lower Crossroads, Luzuko Park, Philippi Industrial and Thabo Mbeki.

January 2013



City of Cape Town – 2011 Census – Ward 080

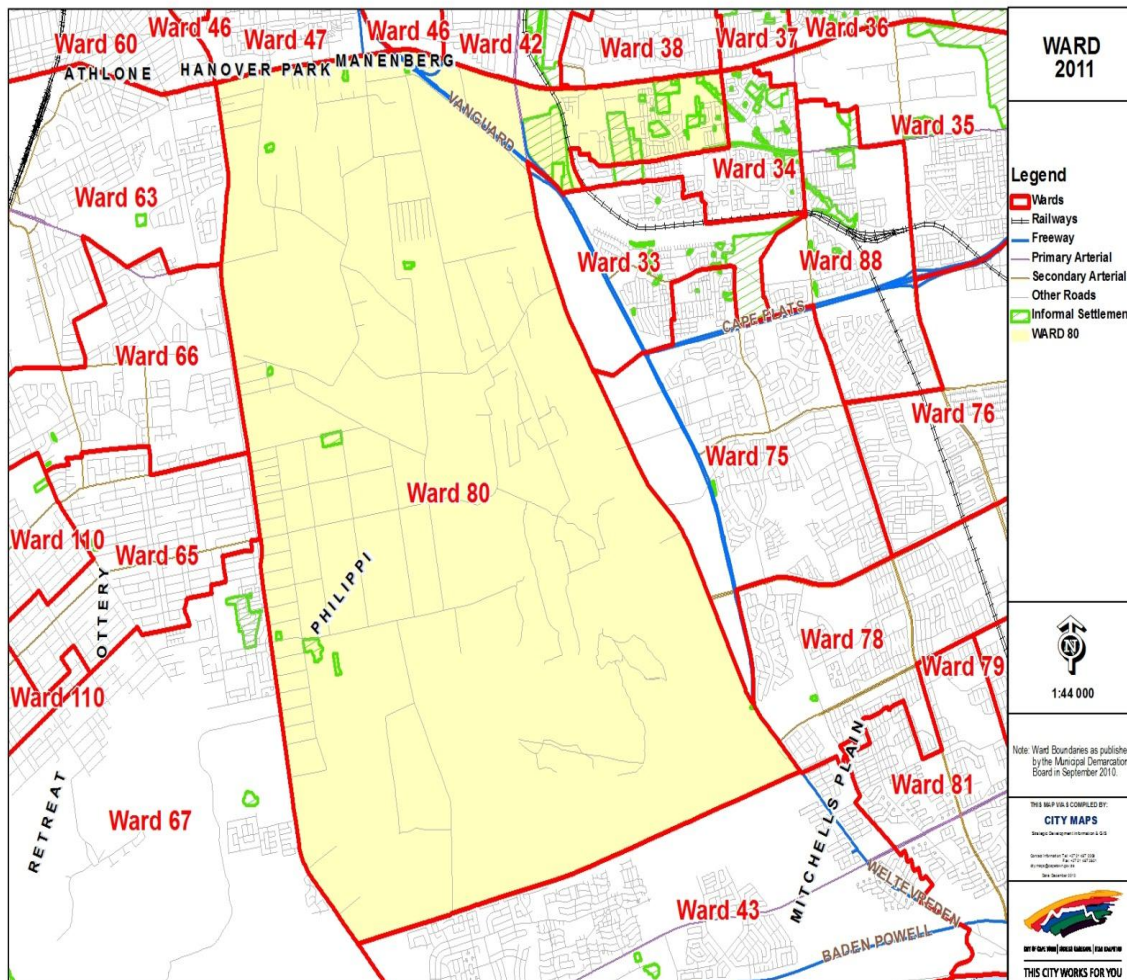
Compiled by Strategic Development Information and GIS Department, City of Cape Town 2011 and 2001 Census data supplied by Statistics South Africa (Based on information available at the time of compilation as released by Statistics South Africa)

[Ward Overview](#), [Demographic Profile](#), [Economic Profile](#), [Household Services Profile](#)

Ward Description

Ward 080 includes the areas of Philippi.

January 2013



City of Cape Town – 2011 Census – Ward 088

Compiled by Strategic Development Information and GIS Department, City of Cape Town 2011 and 2001 Census data supplied by Statistics South Africa (Based on information available at the time of compilation as released by Statistics South Africa)

[Ward Overview](#), [Demographic Profile](#), [Economic Profile](#), [Household Services Profile](#) Ward Description

Ward 088 includes the areas of Lentegeur, New Woodlands, Philippi and Philippi Park.

January 2013

