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Implementation of flood early warning systems in Mozambique

- A stakeholder involved process?

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Abstract

The interest in early warning systems, EWS, has intensified the latest decade since climate change is predicted to make new hazards arise and known hazards emerge in new places. EWS for natural hazards can be used to support settlements to develop in relatively safe areas and to shed light on obstacles along the path of development. The use of people-centered approaches and stakeholder involvement is within the policy and research field of policy implementation in developing countries and EWS for natural hazards often highlighted as methods and strategies that can help to explain the outcomes of an implementation.

Implementation of flood EWS however is a topic that is deficient in earlier research. Which factors impact the outcome of these systems is one area where information is necessary in order to improve future implementations and establish sustainable policies.

Mozambique's development in preparedness and use of flood EWS since the flooding of 2000 has internationally been portrayed as a success story. This study aims to understand if a stakeholder involved approach has been used in the implementation of flood EWS in Mozambique and, if so, in what way this stakeholder involvement could help explain the successful implementation. Using an ideal type analysis, conducting informant interviews and gathering documents the findings show that stakeholder involvement is a part of the successful flood EWS implementation in Mozambique.

This study suggest that stakeholder involvement seems to be a central piece along the lines of how earlier research has portrayed it concerning other implementation and EWS fields than flood EWS. Even though there are no blueprint solutions the results show that people centered approaches and stakeholder involvement can be useful instruments in order to carry out enhanced flood EWS. This study also suggests that the attitude and treatment of stakeholder involving strategies and people centered methods from of a key actor seem to be of noticeable importance when creating relationships with other involved stakeholders. These pieces are elements that can be highlighted in future research and also could play an important part in potential future successful implementations of flood EWS.

Keywords: Flood early warning systems, Implementation, Disaster management, Stakeholder involvement

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List of abbreviations:

ARA	Administração Regional de Aguas / Regional Water Administration
CENOE	The National Emergency Operations Center
CTGC	The Technical Council of Disaster Management
CVM	Cruz Vermelha de Moçambique / Red Cross Mozambique
DNA	The National Directorate of Water
EWS	Early Warning Systems
INGC	The National Institute for Disaster Management
INAM	Instituto Nacional de Meteorologia / National Meteorological Institute
NGO	Non-governmental organisation
UN-ISDR	United Nations – International Strategy for Disaster Reduction

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1. Introduction

One of the consequences of the Indian Ocean tsunami that hit the world in December 2004 was a surge of interest in developing early warning systems to avoid similar natural disasters in the future. The Tsunami that struck Japan in March 2011 and the impact it has had on the nuclear power plant in Fukushima clearly display that the need of such systems is still of immediate importance.

One of the predicted consequences of climate change is that new hazards arise and known hazards emerge in new places. The frequency and magnitude of many types of extreme weather events like floods, droughts and tropical cyclones is expected to increase due to climate changes.[1] Thus, interest in early warning for all kinds of traditional, natural and anthropogenic hazards has intensified. That disasters are increasing in number and severity has also led to the United Nations strengthening international institutional frameworks to reduce disasters.[2]

Early warning systems, EWS, can be used to support settlements to develop in relatively safe areas and to shed light on obstacles along the path of development. For instance, a flooding disaster may only take a few hours, days, or weeks to arise but its undesirable consequences might impact development efforts for years to come. An efficient EWS can assist individuals as well as societies to deal with potential disasters and support the process of sustainable development. The importance of a disaster management that consists of multilevel governance systems which facilitate and enhance the capacity to cope with uncertainty and surprise by mobilizing diverse sources of resilience has therefore been stressed.[3]

Assuming that the linkages between natural resources and conflict are given in Africa it becomes important that early warning and early response systems include issues of natural

[1] IPCC. 2007a. Climate Change 2007: The Physical Science Basis. (Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.), Cambridge University Press, Cambridge).

[2] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A.* Vol 364, pp 2167–2182.

[3] Adger, N., Hughes, T. P, Folke, C, Carpenter, S, Rockström, J. 2005 'Social-ecological resilience to coastal disasters', *Science*. Vol. 309, pp, 1036-1039.

resources and climate change.[4] Flooding could for example make large areas unlivable and thus force the areas population to migrate, temporarily or long term, which in turn could cause tensions in the region where they migrate. The probability that changes in precipitation due to climate change might increase the risk of floods is also one reason why further knowledge about flood early warning systems is particularly relevant.

During the last few decades stakeholder involvement and the use of people-centered approaches have emerged and are flourishing within the policy and research field of implementation in developing countries, as well as the policy and research fields of EWS for natural hazards. These methods and strategies are seen as factors that can help explain the successful outcome of an implementation.[5]

Implementation of flood EWS however is a topic that is deficient of earlier research. Which factors impact the outcome of these systems is one area where information is required in order to improve future implementations and establish sustainable policies on the subject. Evaluations related to the flood EWS implementation in Mozambique have been made before, but even if these assessments are well researched and filled with interesting facts they are not designed or presented in a scientific form.[6]

Mozambique's disaster risk management, lead by the The National Emergency Operations Center, INGC, has been universally acknowledged for their preparedness and contingency planning.[7] One important element in INGC's disaster risk management is their use of warning systems. Mozambique's development in preparedness since the huge flooding of 2000 has internationally been portrayed as a success story, particularly by the Red Cross.
'Mozambique has made great progress in early warning systems, linking them to early action… in 2007 and 2008, the country again experienced severe floods but the reported death

[4] Smith, Vivekananda. 2007. 'A Climate of Conflict: The Links between climate change, peace and war', International Alert.
[5] Ebi & Schmier. 2005. 'A Stitch in Time: Improving Public Health Early Warning Systems for Extreme Weather Events', *Epidemiologic Reviews*, Vol 27. Thomas, John W. and Grindle, Merilee S., 1990. *After the Decision: Implementing Policy Reforms in Developing Countries*, World Development, 18 (8):p. 1164. Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A*. Vol364, UN 2005. 'Hyogo Framework for Action 2005–2015: building the resilience of nations and communities to disasters'.

[6] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank
[7]For example: Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 185, http://www.guardian.co.uk/commentisfree/2007/may/31/preparationiseverything

toll showed a decline, due in part to the effective early warning system that had been established and is linked to early action at community level.'[8]

This development in Mozambique is remarkable considering their geographically and economically vulnerable position as the country is considered one of the least developed nations in the world. If the implementation of effective flood EWS could be carried out successfully in these circumstances it also seems reasonable to believe that the Mozambican experiences and methods has a good probability to be effective also in areas that are less vulnerable but still are in need of flood EWS.

What makes the Mozambican case even more interesting for this study, however, is that elements of people-centered approaches and stakeholder involvement have been claimed to have paved the way for the implementation.[9] To investigate the implementation of flood EWS in Mozambique is thus an interesting entry point since the implementation of flood EWS in Mozambique is described as successful. In particular it becomes of interest to test if stakeholder involvement is a factor that can explain this outcome.

1.1. Purpose and research questions

The overall purpose of this study is to increase our understanding of how- if at all- a stakeholder involved approach has been used in the implementation of flood EWS in Mozambique and- if so - could this stakeholder involvement help explain the successful implementation of flood EWS. In order to facilitate this research an initial mapping of the actors involved in the flood EWS in the country has been done.

The thesis uses a theory testing approach with the Mozambican case in focus and should contribute to the theory field of implementation of EWS in general and flood EWS systems in Mozambique in specific.[10]

The research questions in the study are:

[8] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross. p. 7.
[9] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 201,
[10] Esaiasson, and others. 2009. Metodpraktikan. pp 35-36,

Which stakeholders within the field of flood early warning systems exist in Mozambique?

Could elements from the stakeholder involving implementation model be found in the case of implementation of flood early warning systems in Mozambique?

If stakeholder involving methods are found in what way could they help explain the successful implementation of flood EWS in Mozambique?

2. Theoretical approach

The theoretical section starts with a presentation of EWS and disaster management. The theory section then moves on to discuss different forms of implementation theories in particular a theory of policy implementation in developing countries and a theory that deals with implementation of EWS. The theoretical section ends with highlighting this thesis contribution.

2.1 Early warning systems and disaster management

An information system in disaster management should ideally help to identify needs, and monitor and organize the inflows and distribution of response, assistance and reconstruction aid from international organizations, governments and NGOs. The system should also facilitate the management of aid efforts by offering transparency and accountability. Hence different forms of EWS become an important component in a successful disaster management. [11]

EWS initially got attention in the 1970s and 1980s in relation to the extensive droughts and famines in the Horn of Africa and in the West African Sahel. To avoid future starvation disasters, famine EWS for humanitarian purposes were constructed in the risk countries and regions in sub-Saharan Africa. During the past two decades the systems have developed significantly. In the present day formal EWS exist for almost all vulnerabilities and dangers one can think of − technological, hydrological, meteorological, as well as anthropogenic. Systems also exist for ecological changes, conflict, health-related and complex humanitarian crises.[12]

[11] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 185
[12] National Center for Atmospheric Research 2003. 'Usable Science 8: Early Warning Systems: Do's and Don'ts'. Report from workshop

EWS are often described as an important instrument for governments to attain a sustainable development. They can be used to support settlements to develop in relatively safe areas and to shed light on obstacles along the path of development. For instance, a hydro meteorological disaster may only take a few hours, days, or weeks to arise but its undesirable consequences might derail development efforts for years to come. Efficient EWS can assist individuals as well as societies in dealing with potential disasters and support the process of sustainable development. In the footsteps of global warming and its consequences, interest in early warning of all kinds of traditional, natural and anthropogenic hazards has increased noticeably over the past few years, as new hazards arise and known hazards appear in new places. It is essential for a society to remain alert and EWS provide them with one way to remain on their guard.

In this context the EWS that are considered are foremost the ones concerned with geophysical hazards such as: storms, floods, droughts, landslides, volcanic eruptions, tsunamis etc. Related hazards that include a geophysical component such as locust plagues, wild-land fires and famines also are included.[13]

There are many definitions of an EWS that are used to guide the actions of individuals, groups, and governments. What an EWS should do for a government, society, corporation or an individual, however, is open to debate and scientific disagreements exist in the research field. How effective an early warning might ever be, it still seems reasonable to expect that problems will arise in the affected region. The lessons learned from past occurrences therefore still ought to be of interest in any EWS.[14] A universally established definition of an EWS does not yet exist and perhaps never will. EWS have however been highlighted as an important element in the effort for attaining a sustainable development. The UN description of early warning systems is as follows:

'The provision of timely and effective information, through identifying institutions, that allow individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response'.[15]

[13] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A*. Vol364, pp 2167–2182.
[14] National Center for Atmospheric Research 2003. 'Usable Science 8: Early Warning Systems: Do's and Don'ts'. Report from workshop.
[15] UN/ISDR. 2003. *Living with risk: A global review of disaster reduction initiatives.*

The outcome of an effective EWS for natural catastrophes also goes in line with the human security concept that UNDP embraces. One of the main results such a system provides is preventive measures that minimize human casualties and suffering by supplying information about these events in time. [16]

Four interacting elements have been concluded as essential to make an EWS effective and complete: (i) risk knowledge, (ii) monitoring and warning service, (iii) dissemination and communication and (iv) response capability.[17] These four elements should not be seen as a linear model. Instead each element has direct two-way linkages and interacts with each of the other elements. The monitoring and warning service is the element that has gained most attention and also is the most well recognized part of an EWS. Experiences have shown that predictions by themselves, no matter how technically high-qualitative they might be, are not enough to attain the desired decrease in losses and impact. The human factor in EWS has accordingly been distinguished as very important. Failures in EWS usually occur in the preparedness and communication elements. Strong political commitment and durable institutional capacities have been pointed out as important factors in order to sustain the four elements over the long run. These factors are in their turn dependent on public awareness and appreciation of the benefits of effective warning systems. Characteristically the public support and awareness is often high soon after a disaster event and these moments can be capitalized on to reinforce and secure the sustainability of EWS.[18]

EWS for natural hazards is commonly regarded as an arrangement that comprises a linear set of connections - from observations through warning generation and transmittal to users in form of a 'warning chain.' The meteorological community often uses the term 'end-to-end' warning system. This concept aspires to make forecasts and warnings more relevant and useable to end-users. The development can partly be explained by the commercialization imperative in many national meteorological services.

[16] Elliot, Lorraine 2004. *The International Politics of the Environment*. Palgrave: New York.

[17] ISDR 2005. Can be seen at: http://www.unisdr.org/ppew/info-resources/docs/IEWP.pdf

[18] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A.* Vol364, pp 2167–2182.

The end-to-end concept highlights the necessity to have all the links in the early warning chain in place and systematically connected. In the centre of all EWS there must exist some sort of model that describes the relevant characteristics of the hazard phenomenon and its impacts, especially their time evolution. This model can in its turn provide ways to make projections of possible future events and what actions that might be required in response to these events. Models could be elaborated physics-based global numerical weather prediction models or uncomplicated traditional mental models like 'common knowledge', e.g. that the loud approaching tsunami wave will appear in a few minutes. These models might be slowly evolving, as in a drought model where the degradation of soil moisture may occur over months, or very rapid such as a cyclone or an earthquake. Models could also underlie the other parts of the warning systems like the probable impacts of the hazard, the manner in which the warnings are communicated and acted on, and the dynamics of the evacuation process. Generally however, these vulnerability and response process models are much less developed than the geophysical process models.[19]

2.2 Theoretical critique on EWS

This linear model of EWS described above has been criticized for being with little or no engagement of end-users or their representatives. This is explained by the fact that scientists and technologists typically are the core stakeholders in EWS as they are custodians of the geophysical and technical knowledge upon which the warning system relies. EWS thus tend to be largely conceived as hazard-focused, top down, linear and expert driven systems.[20]

Some of the shortcomings with the end-to-end linear paradigm that have been observed are that the focus remains on the hazards, the vulnerabilities, risks and response capacities are less highlighted. These hazards are dealt with by separate independent technical institutions; possible synergies of mutual benefits are thus not emphasized enough. That the experts have such a dominant role can lead to difficulties in user appreciation of such things as the meaning of a warning, warning uncertainty, the feature of false alarms and the vital responses to different kinds of warning. It has also been noted that knowledge and research from fields other than the core area of expertise are often not acknowledged. Little engagement or

[19] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A.* Vol364, pp 2167–2182.

[20] Ibid, pp. 2167–2182.

empowerment of the people at risk in the design and operation of the warning system could also create a lack of ownership in the system, which can increase mistrust toward experts and authorities. The lack of incorporation of knowledge, experience and feedback from the users and people at risk is another shortcoming that has been underlined. In other words: a lack of stakeholder involvement. A weak public recognition and engagement furthermore tends to lead to weak political and budgetary support for EWS.[21]

In order to ensure proper inputs from both the natural sciences and the social sciences, a 'people-centred' approach has been suggested. It requires several systematic approaches and diverse activities across the four elements of EWS described earlier. This includes: identifying target populations, particularly the vulnerable and disadvantaged and interacting with them in order to determine the capacities and needs. Involvement of communities in the step of exploring and mapping their risks and planning their responses is emphasized. Organizing town meetings so the development of the communities' responsibility for monitoring and involvement in the warning system could be fostered and could generate public information that is adjusted to the target groups. People-focused standards and benchmarks for performance standards for technical warnings systems, and development of formal mechanisms for how public representatives shall monitor and oversee the system could be established. Measuring public awareness and satisfaction through surveys, providing training on social factors for technical experts, authorities and communicators who operate the EWS could also be implemented.[22]

An EWS does not necessary have to include a formal bureaucratic structure with organizational charts showing who reports to whom. In many societies there are uncharted patterns of human communication that accomplish the functions of EWS. Those systems have been learned from generation to generation in order to manage certain hazards.[23] When it comes to floods, however, communities in many places in the world have reported that floods seem to be arriving faster and fiercer than 30 years ago. Risk reduction and disaster preparedness based solely on past experience will therefore in many cases no longer suffice facing the significant trends in hazards and impacts.[24]

[21] Ibid, pp. 2167–2182.
[22] Ibid, pp. 2167–2182.
[23] National Center for Atmospheric Research 2003. 'Usable Science 8: Early Warning Systems: Do's and Dont's'. Report from workshop.
[24] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross

Some general components necessary for a successful EWS can be identified above, in particular the importance of a people-centered approach and stakeholder involvement. More seems to be written on the principals of EWS and less seems to be known about how these warning approaches are translated into practices. In order to explore how EWS may successfully be implemented we now turn to discussing different forms of implementation theories that could be applied on the field of flood EWS.

2.3 Theories on policy implementation in developing countries

The linear model of implementation is based on a perception that the process of implementation is a straightforward procedure.[25] A suggested reform gets on the agenda, a decision is taken and the new policy is implemented, either in a successful or unsuccessful manner. The focal point in this model is the decision in itself, implementation is considered to be of less importance. Either implementation is disregarded or it is viewed as someone else's responsibility. Whether the implementation is successful or not in this view depends on how strong the institution that is carrying out the task is. If the implementation fails this usually is explained by a requirement of a stronger institutional capacity. Alternatively the unsuccessful implementation could also be blamed on the lack of political will, which could be considered as a weak argument with little analytical content.[26]

By using this approach Thomas and Grindle (1990) argue that one misses that a large amount of work is still ahead after making a decision to adopt a new policy.[27]

The interactive model of implementation on the other hand is based on the belief that the pressures and reactions from those who oppose a policy reform initiative could reverse or alter it at any stage of its life cycle. In this sense the interactive model considers policy reform as a process where interested parties can cause change.[28] Thomas and Grindle suggest that the decision process needs to be visualized as a series of formal and informal stages with several actors and not as a single point with a lone decision maker. They emphasize that new policies

[25] Thomas, John W. and Grindle, Merilee S., 1990. *After the Decision: Implementing Policy Reforms in Developing Countries*, World Development, 18 (8), See also: Nakamura, R. T.,and F. Smallwood. 1980. *The Politics of Policy Implementation* , New York: St Martin's Press, Pressman, Jeffrey, and Aaron Wildavsky. 1973. *Implementation.* Berkelev. CA:Universitv of California Press.

[26] Thomas, John W. and Grindle, Merilee S. 1990. After the Decision: Implementing Policy Reforms in Developing Countries, *World Development*, 18 (8):p. 1164.

[27] Ibid, p. 1165.

[28] Ibid, p. 1166.

are especially vulnerable in the implementation phase since the effects of the change become more observable as implementation proceeds. This makes it more likely that more challenges will be raised to the original concept of the reform.[29]

Reforms need political, managerial, financial and technical resources. How much of what depends on the specific reform but the important thing is that the reformers know what is needed and where they can get hold of it. The ones making the decisions must therefore weigh political resources for policy implementation while public managers must look at bureaucratic resources – financial, managerial as well as technical.[30]

Besides listing those who oppose and support a reform it is also important to assess the degree to which this support can be mobilized and how powerful each fraction is likely to be as well as how information will reach people. Three factors primarily decide the importance of potential support: location, organization and socioeconomic status, which include literacy.[31]

An essential part of a successful strategy composed by a government is thus to predict the arena of reaction and analysing stakes involved and resources available. Stakeholders and mobilization could be important ingredients that need to be taken into consideration when desiring to manage a new policy in a successful manner.[32]

So basically implementation can be improved if: (i) The arena of reaction is predicted (ii) The stakes involved (stakeholders, mobilization etc) are being analysed and (iii) The resources that are needed are assured to be available.

This theory gives us further knowledge on which factors can facilitate implementation of polices in developing countries. In line with the section describing EWS, the importance of this theory gives us further knowledge on which factors can facilitate implementation of polices in developing countries. In line with the section describing EWS, the importance of stakeholders is one factor that is emphasized as important in order to improve implementation.

[29] Ibid, p. 1166
[30] Ibid, p. 1175
[31] Ibid, p. 1176
[32] Ibid, p. 1174

2.4 Implementation of EWS

The implementation of flood EWS is a relatively new research field and thus has some gaps that need to be strengthened. Understanding which factors impact the outcome of the warning systems is one of the areas where knowledge is limited. A perfectly designed EWS that gives accurate scientific information about an incoming natural disaster in the right time is still of little value if the warnings are not heeded. That all EWS in some sense are unique and need to be adjusted to their specific context is perhaps one explanation to this deficiency. Some theories within the field of EWS however have closer ties to flood EWS than others e.g. Ebi & Schmiers (2005) account of how Public Health EWS for extreme weather events could be improved. This system is similar to flood EWS in the sense that they are both designed for geophysical hazards that can appear quickly and essentially demand collaboration and coordination with meteorologists to be effective.

The main components of an EWS include identification and forecasting of the event, prediction of the possible outcomes, an effective and timely response plan and an ongoing evaluation of the system and its components. To increase the likelihood of successful implementation all relevant stakeholders should be involved in the development of the system to ensure that the issues of greatest concern are identified and addressed. Stakeholders that should be included are the agencies and/or organizations that will finance the development and operation of the system, the groups that will be likely to take action, and those expected to be affected by an extreme incident. By including persons that previously have been affected by extreme events local knowledge about responses and their effectiveness may be included in the process.[33]

As described EWS for public health in extreme weather events carries many resemblances to the flood EWS and therefore Ebi & Schmiers theory concerning the improvement of the implementation of EWS for public health in extreme weather events becomes relevant in order to determine how the implementation of the flood EWS in Mozambique has been carried out.

[33] Ebi & Schmier. 2005. 'A Stitch in Time: Improving Public Health Early Warning Systems for Extreme Weather Events', *Epidemiologic Reviews*, Vol 27.

2.5 Thesis contribution

As mentioned above more appears to be written about what EWS for natural hazards are than how they are being implemented and why they succeed or fail. Basher (2006) is giving one piece of the explanation of the outcome of EWS implementation by claiming that EWS must be both technically systematic and people-centered, stakeholder involving, and suggests a model for how this should be accomplished and also underlines the shortcomings with many current linear systems. These suggestions are made on a general level assumed to concern all EWS for natural hazards, how they impact specific EWS like the ones designed for floods is not elaborated further on.[34] The work of Ebi & Schmier (2005) relating to how public health EWS can be improved is another step in the direction of explaining the implementation outcome by declaring that more focus must be on prediction and prevention instead of surveillance and response. That stakeholders should be involved to ensure the maximum effectiveness of the EWS is another conclusion from their research.[35] Unlike this thesis however their research does not either concern flood EWS in general or the specific system in Mozambique. The disaster management and the flood EWS of Mozambique have been evaluated before in particular in a World Bank report from 2008. In this report Sasin presents a detailed picture on how the sharing of information between involved actors was handled during the 2007 flooding. This report also gives a detailed description of the structure of the disaster management in Mozambique. The aim of the report is to be used for a cross country analysis of how information systems have been used in disaster management.[36] Samins work appears to be very well researched and gives many interesting details about the disaster management system in Mozambique. The report does not however focus on the relevance of the stakeholder involvement and what impact this approach has had on the outcome of flood EWS.

The case of Mozambique is chosen on the basis that the country often is mentioned as an example where the implementation of flood EWS has been successful.[37] This study set out to contribute to research on why Mozambique has succeeded with their implementation of flood EWS.

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[34] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A.* Vol364, pp 2167–2182.

[35] Ebi & Schmier. 2005. 'A Stitch in Time: Improving Public Health Early Warning Systems for Extreme Weather Events', *Epidemiologic Reviews*, Vol 27

[36] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank

[37] For example: http://www.guardian.co.uk/commentisfree/2007/may/31/preparationiseverything , World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross and Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 185.

To get a more deep understanding of the Mozambican case, existing theories on EWS, implementation of policies in developing countries and implementation of EWS for public health in extreme weather events in specific is applied to implementation of flood EWS in Mozambique. The importance of stakeholder involvement in order to achieve a successful implementation is, regardless of the theory sector, a recurring aspect addressed by the theory conceptions used in this study. By using characteristics from these theories two ideal types are created and a 'stakeholder involved model' is searched for in the case of flood EWS implementation in Mozambique. This study is done in order to determine how influential the stakeholder involved model has been in this particular case and in what way stakeholder involvement can help to explain the successful outcome.

Implementation research is a rather new research area compared to other areas within public policies analysis like public policy formulation.[38] Through the composition of this thesis flood EWS is brought into implementation research in order to concentrate on so-called implementation output which in this case is how implementation practices are being done and the ambition is to bring more insights into the bulk of implementation research.

By writing about implementation of flood EWS in Mozambique, this thesis also hopes to bring valuable information about the status of stakeholder involved implementation models in Southern Africa. The ambition with this study is to use the theories described above to create an analytical tool in order to do a theoretical testing of a linear and a stakeholder involved implementation model.

2.6 Presentation of the analytical scheme

Figure 1: The analytical scheme

[38] Hill, Michael. *The Public Policy Process*. Essex: Pearson Education Limited, 2005.

The two ideal types

Implementation Models	Stakeholder involved Model	Linear Model
Category 1: Objectives What should the flood EWS achieve?	A people-centred warning system with a clear community involvement that can be tailored to the specific local conditions.	A warning system that is providing information for floods. Where the hazard itself is emphasized.
Category 2: Overall involvement Should stakeholders be involved in the implementation process?	Yes. To increase the likelihood of successful implementation all relevant stakeholders should be involved.	No. The institution responsible for carrying out the implementation of the policy is the experts and has the responsibility for its success.
Category 3: Involvement of local population How have the local populations in disaster areas been involved in the shaping of the flood EWS?	That local knowledge about responses from people that previously has been affected by floods is included in the process is a prioritized area.	The involvement of the local population in the shaping of the EWS is not a prioritized area.
Category 4: Causality What explains the outcome success/lack of success of the EWS implementation?	A multi-level stakeholder involvement including both financing and developing organizations as well as the groups that will be affected and are likely to take action in case of extreme incidents	The institutional capacity/strength and amount of political will.
Scale	Close to LM Closer to LM	Close to SI Closer to SI

Source: Basher. 2006; Ebi & Schmier. 2005; Thomas & Grindle. 1990.

3. Methods

3.1 Why examine the implementation of flood EWS in Mozambique?

Implementation of flood EWS is a topic that is deficient of earlier research and as mentioned above knowledge of what factors that has impact on the outcome of the flood EWS is an area with limited scientific knowledge. Evaluations related to the flood EWS implementation in Mozambique have been made but even if these assessments are well researched and filled with interesting facts they are not designed or presented in a scientific form that concerns stakeholder involvement. Unlike this thesis these assessments do not focus on the particular impact that the involvement of stakeholder has had on the outcome of flood EWS. [39]

How policy decisions in developing countries and indeed other forms of systems for early warning could be successfully implemented has on the other hand been researched more carefully.[40] A relevant part of this research is used in this thesis in order to create the analytical tool in form of ideal types for two implementation models: a 'linear model' and a 'stakeholder involving model'. How this analytical tool has been used and which the criteria's for conclusions are will be explained further down.

In the research field of implementation of policies in developing countries the involvement of different stakeholders is regularly seen as a factor that can help to explain the success or the failure an implementation.[41] To investigate if an involving approach has been present in the successful implementation of flood EWS in Mozambique consequently becomes of interest. If that is the case this could contribute with knowledge and understanding to how the implementation process can be successfully transferred to other countries and areas with similar problems.

In the disaster risk management context Mozambique stands out in several aspects. On one hand the country is one of the geographically and economically most exposed countries in the world. On the other hand their way of developing disaster risk management in general and early warning in specific has been hailed as a success story. The Mozambican example is

[39] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank
[40] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A.* Vol. 364, Thomas, John W. and Grindle, Merilee S., 1990. *After the Decision: Implementing Policy Reforms in Developing Countries*, World Development, 18 (8), Ebi & Schmier. 2005. 'A Stitch in Time: Improving Public Health Early Warning Systems for Extreme Weather Events', *Epidemiologic Reviews*, Vol 27.
[41] Ebi & Schmier. 2005. 'A Stitch in Time: Improving Public Health Early Warning Systems for Extreme Weather Events', *Epidemiologic Reviews*, Vol 27. Thomas, John W. and Grindle, Merilee S., 1990. *After the Decision: Implementing Policy Reforms in Developing Countries*, World Development, 18 (8):p. 1164.

often highlighted as a successful example of the implementation and progress in EWS and the linkage to early action.[42] In 2000 the flooding in Mozambique was severe and the need for international help to save people lives was immense. In 2007 and 2008 the country experienced severe floods again but the death toll had dropped significantly. Their establishment of an effective early warning system linked to early action at community level after the floods of 2000 has as a result been lifted as one explanatory factor for this development.[43]

That Mozambique despite their vulnerable situation has made great progress in flood EWS in a relatively short time period makes their implementation of flood EWS an interesting case. If the implementation of effective flood EWS has been carried out successfully in Mozambique surrounded by these demanding circumstances it seems reasonable to believe that the Mozambican experiences and methods have a good probability to be effective also in areas that are less vulnerable but still are in need of flood EWS. By increasing the understanding of how the implementation of flood EWS in Mozambique has been carried out, the chances of a successful transfer of their experience to other countries with similar problems improves. Even though it has reasonably been pointed out that there is no 'one size fits all' EWS for all hazards in all countries aspects of people-centred EWS can most certainly be applied in other contexts.[44] That the problems of flooding are expected to increase, not least in Southern Africa, as a consequence of climate change makes a growing knowledge of this field highly relevant.[45] The possibilities to transfer the experience of Mozambique to other countries have also been estimated as high.[46]

3.2 The analytical tool

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[42] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross
[42] For example: http://www.guardian.co.uk/commentisfree/2007/may/31/preparationiseverything , and Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 185.

[43] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross p 7.
[44] Ibid, p. 11
[45] IPCC. 2007a. Climate Change 2007: The Physical Science Basis. (Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, S.
Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.), Cambridge University Press, Cambridge).

[46] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross p. 11.

The analytical tool consists of two ideal types for implementation based on existing theories on EWS and implementation. The stakeholder involved model includes contemporary views on characteristics that increase the chances of successful implementation established within the policy field of implementation of policies in developing countries as well as the research fields of both early warning systems and implementation. By bringing a linear model to the analysis this model serves as an opposite ideal type in order to have a point of comparison. When examining if a stakeholder involving approach can be found in the case of implementation of flood EWS in Mozambique or not, the linear model is used as a 'counterweight' to understand if it instead could be the opposite view that is present. The ideal types are presented in four levels: objectives, overall involvement, involvement of local population and causality. When comparing the interview answers with the ideal types possible, correspondent similarities, or absence of them, should be found.[47] The ambition is that the ideal types shall be mutually exclusive or as a minimum it should be shown that there is a clear difference between them. The chosen theories should capture the essence of the main arguments for using stakeholder involving and people-centered approaches when implementing EWS. The ambition is that the ideal types should a be parallel in the sense that one characteristic in one ideal has an contrary in the other.[48]

The two ideal types are only a help to understand how Mozambique has implemented their flood EWS, they shall not be expected to exist in their pure form in reality since they are extreme images of a phenomenon.[49] By using a predefined approach an independence from the material itself is allowed. The use of an open approach in this study would eliminate to find a possible correspondence between the 'stakeholder involving model' and the flood EWS implementation in Mozambique and is thus considered as unsuitable. By using a predefined tool the motivation of conclusions, presentation of conclusions and focusing on the thesis purpose is also facilitated.[50]

The two ideal types are presented in section 3.7 and the analytical scheme is outlined in section 2.6.

[47] Essaisson and others 2009. Metodpraktikan. p, 159.
[48] Ibid. p, 156, 161-162.
[49] Ibid. p, 158
[50] Ibid. p, 244

3.2.1 Criteria's for conclusions

If stakeholder involving methods are found in the case of implementation of flood EWS in Mozambique, and this is the most prominent approach, the stakeholder involving approach could be considered as *one* explanatory factor for the success. It is not necessary that the results have to correspond literally or precisely the meaning should however be the same. Whether the stakeholder involved model or a more linear model is found in the Mozambican case this should be shown by the analytical tool. If elements from the stakeholder involved model aren't present this should also be determined by the analytical tool, the ideal type for a linear model is used to see if the contrary view is the one that rather corresponds.

My views and interpretations of the material will certainly stipulate the results. Through using created ideal types with close theoretical connection this influence should however decrease. By addressing the material objectively and openly describing the criteria's for conclusion I aim to present my results in a fair way through the analytical tool. By using two ideal types the motivations and sorting of the material is presumed to go smoother. [51]

Instead of presenting my results as 'more' or 'less' of an ideal type my results will be showed in the terms of 'closer to' or 'close to' the ideal types. By doing this I will carefully try to determine if one ideal type is showed more than the other. [52]

To what extent these correspond to the analytical tool should also be possible to illustrate in a clear way. Which of the two categories is most prominent in the implementation could however lead to problems concerning interpretation- and boundary establishment.[53] This problem is dealt with through openly arguing where in the analytical tool a statement is placed. In order to show a clear distinction between the content of the original text and my own text the results will be presented in citations followed by my motivations, brief summaries and conclusions. [54]

To illustrate how the implementation of flood EWS in Mozambique correspond with the two ideal types the establishment of EWS is divided into four categories: objectives, overall involvement, involvement of local population and causality. To determine if the ideal types

[51] Ibid. p, 158
[52] Ibid, p, 160
[53] Ibid. p, 254
[54] Ibid. p, 253

are found in the Mozambican case at all at least one of the categories should be placed closer to the stakeholder involved model or the linear model. To estimate which of the ideal types that is more prominent in the Mozambican case this ideal type ought to be classified as closer to the case in more categories than the other ideal type. A possible result could for example be that the establishment of flood EWS in Mozambique is closer to the stakeholder involved model concerning the categories objectives, overall involvement and causality but closer to the linear model when it comes to involvement of local population. That is, closer in three categories of four. If this is the case it is possible to say that the stakeholder involved model is most prominent since it is closer to the Mozambican case in most categories.

3.3 Gathering data

The main method for gathering data was to conduct semi-structured informant interviews.[55] The purpose of such interviews was to generate information about how the implementation of flood EWS has been carried out in Mozambique, and if practices have been involving stakeholders. However some data was also collected by collecting relevant official documents considering flood EWS in Mozambique and its implementation.

3.3.1 Informant Interviews

The fieldwork was performed in Maputo between February and April 2011. The first contact was made via email to the University of Eduardo Mondlande and the National Institute for Disaster Management (INGC). After these initial contacts and interviews a snowball sampling was used to reach other relevant informants conversant with the implementation of flood EWS in Mozambique.[56] These informants included government officials and representatives of national and international aid agencies from INGC, CENOE, INAM, DNA, ARA-Sul, GTZ, UNDP, WFP and the Mozambican Red Cross. In total eleven persons were interviewed in nine different interview occasions. Two of these were done with two informants at once.

When using Informant interviews as a method it is recommended to reflect over the reliability of the narratives.[57] The interviews could be used as primary sources however criticism of ones sources is always suggested when using informant interviews in research.[58] In this thesis evaluation of the sources could be claimed to be of particular importance since the informants

[55] Ibid. p, 287.
[56] Ibid. p, 291.
[57] Ibid. p, 303
[58] Ibid. p, 258

to a large extent also are the same persons that are responsible for the implementation of flood EWS in Mozambique. It would not seem unthinkable that the informants feel a loyalty to the activities I ask questions about and that this reflects upon their answers. In order to get the information necessary for this study the expertise these informants can provide is, however, necessary. Several informants have therefore been interviewed in order to determine if any systematic skewness could be found in their answers.[59] The informants that are being interviewed are answering questions they can answer due to their experience in their work related to implementation of flood EWS in Mozambique. Since the implementation process started in 2003 and is still ongoing the distance between the narrator and the narrative is regarded as relatively close in time. One must however bear in mind that even though the interview participants come from different Mozambican institutions, NGOs as well as international organisations and UN-organs, they could be argued to be in close cooperation. The tendency of narrators could therefore be hard to determine. I have for this reason tried to find confirming narratives with different origins - if it's possible, for instance other confirming documentation that could increase the reliability of the results.

3.4 Theoretical expectations on Mozambique's implementation approach

Given the results of earlier research concerning EWS, implementation of policies in developing countries and implementation of Public Health EWS for extreme weather events certain aspects increase the chances for a successfully managed implementation. In the case of EWS the involvement of all relevant stakeholders has in particular been highlighted as a means to ensure that the issues of greatest concern are identified and addressed and that the implementation is successfully achieved. Since the implementation of flood EWS in Mozambique is considered as successful it is thus reasonable to believe that an inclusive stakeholder approach should be found in this case.

If the results show that an inclusive stakeholder approach has been used in the Mozambican case, the policies that praise stakeholder involvement as an important factor to attain a successful outcome when implementing EWS are strengthened. If the results show otherwise, that it is the linear model that is prominent or none of the ideal types are, it can be questioned if a stakeholder involving approach has such an impact as earlier research has declared.

[59] Ibid. p, 322

3.4.1 Critical reflections of methods and data sources

The choice of Mozambique is made on the basis that this case has internationally been hailed as a successful example of implementation of flood EWS. This categorization has been done by NGOs and the donor community which is important to bear in mind when reading this thesis.[60] Their classification of a 'successful implementation' is by no means universal and it could for instance be claimed that it would be more reasonable that the inhabitants of the flood-prone areas should decide whether the implementation has been successful or not. Since such data, local populations' view of the implementation, are not available and no information that contradicts the success label from the donor community and NGOs has been found, the choice remains. If future research should change the perception of how successful the Mozambican implementation of flood EWS is this would of course also have an impact on the results of this study.

One difficulty when performing the interviews was that confusion of languages sometimes led to the question from time to time shifting focus. Since EWS often is one component of a larger disaster risk management it could occasionally be challenging to interpret if the informant was answering about the flood EWS in specific or the disaster risk management in general. The fact that three different forms of EWS exist and are being implemented in Mozambique - and to some extent are interconnected - further blurred the answers now and then. This also makes it somewhat complicated to know for sure that the genuine implementation of flood EWS were being measured. The data created from interviews and documents may instead measure existing ambitions in stakeholder involvement and people-centered approaches and not if the actual implementation practices do use this method. To some extent this difficulty is hopefully overcome by verifying information from different sources.

3.5 Analyzing the data

Based on the ideal types the interview transcripts were coded manually. Statements that could be interpreted as closer to the ´linear model' were highlighted in a yellow colour. Statements that could be interpreted as closer to the 'stakeholder involved model' were highlighted with a green colour. For statements that were unclear whether they were closer to the ideal type 'linear model' or 'stakeholder involved model' a blue colour was used. These findings are

[60] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross, Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank.

presented as short sections of text together with key quotations that can be considered as representative for the text.

3.6 Limitations

This study is limited to the question if stakeholder involving methods have been used in the implementation process of flood EWS in Mozambique, and if they in such case can help explain the successful implementation. The choice of this particular aspect of the implementation process is based on what earlier research on EWS and implementation of policies in developing countries has pinpointed as success factors in their respective fields. This means that the study only focuses on this side of the implementation process and that other factors like available resources, risk knowledge and technical skills etc. that could have impact on the outcome of implementations have not been considered.

Another limitation in this study is that the gathering of data is done through interviews of key informants from Mozambican institutions, NGOs etc and gathering of official documents. The views of the local population living in the flood prone areas where the flood EWS has been implemented is not included. An ever more demanding and tougher way of testing the stakeholder involving model would have been to carry out the research with the local populations and communities involved in the flood EWS in Mozambique. It is possible that information from these groups would lead to a different result considering the occurrence of stakeholder involving measures. The choice of key informants was however made out of practical reasons both in terms of language barriers, gathering data on the countryside would demand an interpreter and lot more time for transcription, and time. By limiting the gathering of data to Maputo several different actors could be interviewed within the time scope of this study.

3.7 Short presentation of the ideal types

The ideal types were developed based on academic literature, mostly from implementation theories on policy implementation in developing countries but also literature on different forms of EWS. The four categories (objectives, overall involvement, involvement of local population and causality) are chosen because it seems reasonable to find practices and views in these parts that have shifted from a traditional linear approach to a stakeholder involving one. When developing the ideal types I strived to find appropriate, and contrasting, features that easily described what a linear- and a stakeholder involved model would look like in the

empirical data. As mentioned above ideal types are, most probably, never found in their pure form in reality. The use of ideal types is however valuable since it could help to show gradation of which implementation model that is used in Mozambique. By being open with my preunderstanding and with what theories that are being used in the study I strive to bring transparency to the process of describing the implementation of flood EWS in Mozambique and also reduce the notion that a predefined approach to empirical data necessarily has to be considered as rigid. [61] The ideal types can help in understanding if the implementation of flood EWS in Mozambique is closer to, or further from, one or the other ideal type. In this study the end goal is to understand if the implementation has been stakeholder involving or not.

3.7.1 The linear model

Both within the research field of implementation of policies in developing countries and EWS the term linear is used to describe traditional methods of implementation. Some of the key features that can be found are that the focal point is the decision in itself and the engagement with the end-users and their representatives is minor or non existent.[62] If this constructed 'linear model' is used when implementing an flood EWS this would result in a system where the hazard itself is in focus and the vulnerabilities, risks and response capacities are considered as less important.[63] A linear model further should advocate that the responsibility for the implementation and its success is the sole responsibility of the liable institution and that other stakeholders should not be involved.

The linear model would also claim that the explanation as to whether the implementation is successful or not is the institutional capacity and the strength and amount of political will.[64] Another characteristic of the linear model is that the involvement of the local population is an unprioritized question.[65]

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[61] Esaiasson and others 2009. Metodpraktikan. p, 158, 244

[62] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A.* Vol. 364, Thomas, John W. and Grindle, Merilee S., 1990. *After the Decision: Implementing Policy Reforms in Developing Countries*, World Development, 18 (8).

[63] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A.* Vol. 364

[64] Thomas, John W. and Grindle, Merilee S., 1990. *After the Decision: Implementing Policy Reforms in Developing Countries*, World Development, 18 (8).

[65] Basher, R. 2006. 'Global early warning systems for natural hazards: systematic and people-centred'. *Philosophical Transactions of the Royal society A.* Vol. 364

3.7.2 The stakeholder involved model

As a reaction to the traditional and linear way of handling implementation, alternative theories and models for attaining successful implementations have been raised and they often share some elements; the importance of stakeholder involvement and people-centered approaches. Within the research field of implementation of policies in developing countries an interactive model could be found, this interactive model considers policy reform as a process where interested parties can cause a change, and accordingly stakeholders become of interest.[66] The underlining of stakeholders being involved in the process in order to increase the likelihood of a successful implementation is also a feature that has been highlighted within the research field of EWS.[67] Other features specific for a stakeholder involving model is the creation of a system were a clear community involvement can be tailored to the specific local conditions.

The stakeholder involved model would put emphasis on the involvement of agencies or organizations that will finance the development and operations of the system as well as the groups that will be likely to take action, and those expected to be affected by the extreme incident. The incorporation of local knowledge in the implementation process is another area that is prioritized from a stakeholder involved model. This could for example be done by including persons that have experienced floods in the past, local knowledge about responses and their effectiveness may in this way be included in the process.[68]

4. The Mozambican case

This chapter describes the given prerequisites for disaster management and the implementation of flood EWS in Mozambique. The chapter begins with a brief historical background of the country and a description of the geographically and economically position of Mozambique. It then continues with information on the existing warning systems descriptions of some involved stakeholders and a brief account on how the implemented flood EWS in Mozambique has been tested.

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[66] Thomas, John W. and Grindle, Merilee S., 1990. *After the Decision: Implementing Policy Reforms in Developing Countries*, World Development, 18 (8).

[67] Ebi & Schmier. 2005. 'A Stitch in Time: Improving Public Health Early Warning Systems for Extreme Weather

[68] Ebi & Schmier. 2005. 'A Stitch in Time: Improving Public Health Early Warning Systems for Extreme Weather

4.1 Disaster management

Since 1976, Mozambique has encountered at least 45 substantial incidences of natural disasters, including floods, cyclones droughts and earthquakes. As much as 25 percent of the country's population faces a high mortality risk due to natural hazards, and it ranks as the second most geographically exposed country in Africa. Mozambique is prone to droughts, floods, cyclones and occasional earthquakes in the south of the Rift Valley.[69] In 2000 Mozambique suffered from major floods that were the worst on record. They caused the death of over 800 people and displaced over half a million of Mozambique's population. The floods also had a huge economic impact on the country. The annual growth rate in gross domestic product dropped from 10 to 2 that year and the losses and damage were estimated at US$600 million.[70]

Mozambique's exposed position and its existing condition of continual vulnerability is something that has to be taken into account when talking about disaster management and disaster risk reduction in the country. With a poverty rate of 54.1 percent for a total population of 20 million (2002) Mozambique remains one of the least developed countries in the world.[71] The country is currently ranked 165th out of 169 countries in the Human Development Index, HDI, ranking (2010).[72] And the gross domestic product per capita is 458 USD (2010).[73] The essential causes of Mozambique's vulnerability are weak infrastructure and basic services together with a rapidly escalating HIV/AIDS pandemic that is weakening national abilities and significantly slowing the rate of development.

Consequently the effect of frequent natural hazards can have an exponential impact by disruption of livelihoods and services and over-stretching of the already limited coping mechanisms of the population.[74]

In addition the recurrent droughts, floods and cyclones that are troubling Mozambique is likely to increase in the future due to climate change. High levels of vulnerability and

[69] UNDP. 2010. 'Community-based best practices for disaster risk reduction'.
[70] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 208.
[71] UNDP. 2010. 'Community-based best practices for disaster risk reduction. p. 31

[72] UNDP: http://hdrstats.undp.org/en/countries/profiles/MOZ.html
[73] http://en.wikipedia.org/wiki/List_of_countries_by_GDP_%28nominal%29_per_capita
[74] UNDP. 2010. 'Community-based best practices for disaster risk reduction. p. 31

susceptibility to climate changes also have a great impact on Mozambique's people, property, livestock, natural resources and physical infrastructure.[75] Studies suggest that the increase in rainfall and river flow occasioned by climate change in Mozambique will occur in January, February and March which also is when the risk for floods in the area is greatest.[76] Currently Mozambican rivers are expected to exceed the flood alert level every two to three years. Floods that are categorized as 'very large', exceeding 1.5 times the flood stage, are expected to occur less frequently about once every 15 to 20 years.[77]

Accordingly Mozambique is a country where the need for well-functioning disaster information is particularly acute.The predictions of more frequently occurring natural disasters as well as the experience from the floods of 2000 have led to the Mozambican government prioritizing the development of the country's disaster risk reduction. The National Institute for Disaster Management (INGC) has been significantly strengthened since 2000. INGC is provided with a direct line of contact with the prime minister and is placed within an institutional structure appropriate for such an important actor. The active and important role of INGC in the preparedness and contingency planning, and during and following disasters has been universally acknowledged.[78] When the country experienced new floods in 2007 and 2008 the final death toll was substantially lower than 2000, around 30 in 2007 and six in 2008. The INGC is the responsible authority for the coordination of all disaster risk management activities in Mozambique and this includes the flood EWS. Their establishment of an effective flood EWS linked to early action at the community level has been pointed out as a key explanatory factor for the death toll development. [79]

[75] OCHA: http://ochaonline.un.org/rosa/Countries/Mozambique/tabid/4369/Default.aspx
[76] INGC. 2009. Synthesis report. INGC Climate Change Report: Study on the impact of climate change on disaster risk in Mozambique. van Logchem B and Brito R (ed.). INGC, Mozambique.
[77] Ibid.
[78] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 241
[79] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross pp 7, 10.

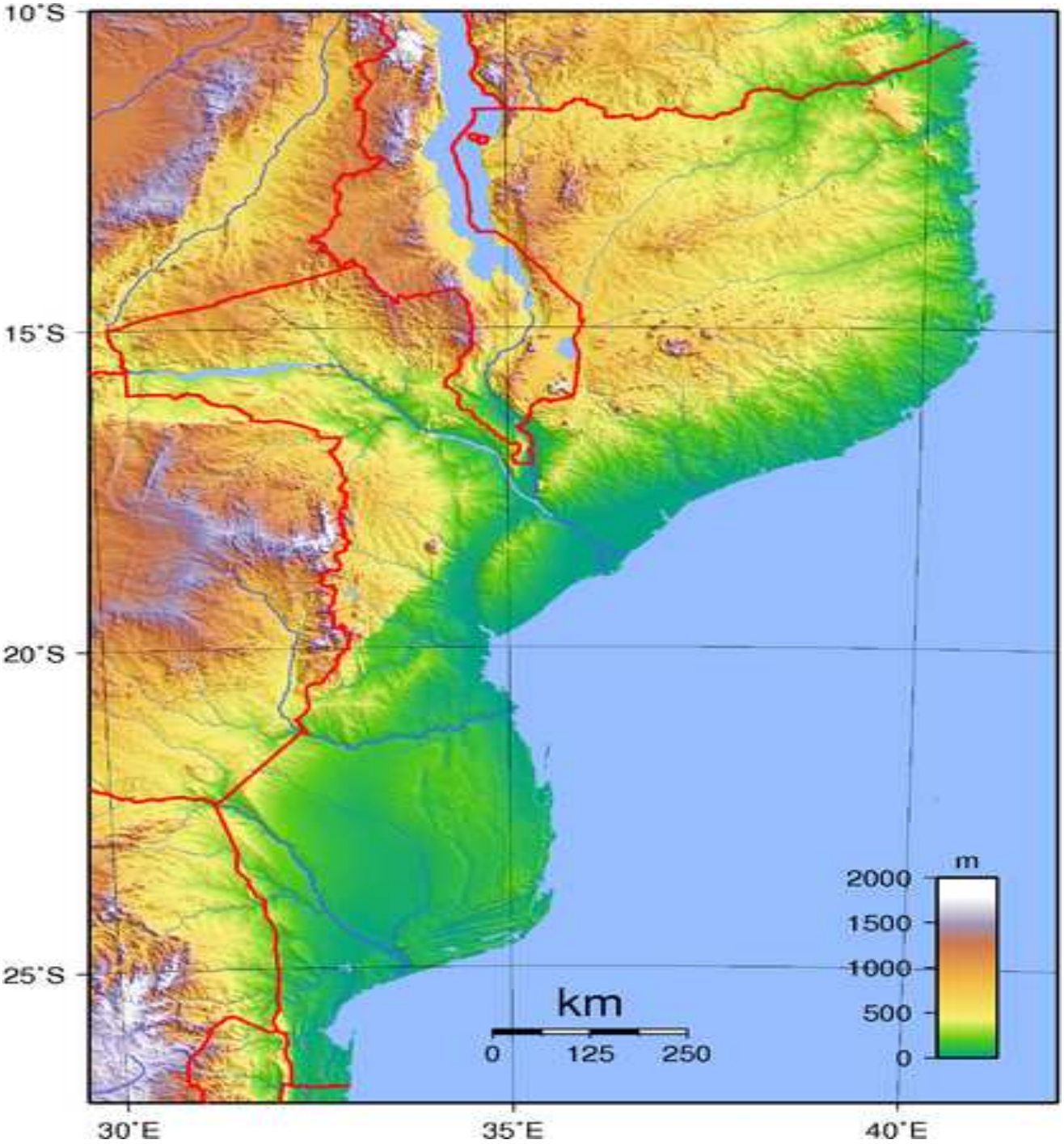

Figure 2: Low lying areas below 20 meters contour line in Mozambique (in green)

Source: http://en.wikipedia.org/wiki/File:Mozambique_Topography.png

The topographic map of Mozambique clearly demonstrates the low lying coastal plain covering much of the country in the south and central zones (green/blue). The higher mountains plateaus inland to the north are also clearly visible.

The legal foundation for disaster management action is provided by the 1999 National Policy on Disaster Management (Política National de Gestão de Calamidades). This law sets up the procedures and the legal framework for mechanisms for coordination and resource mobilization as part of disaster prevention and response. It emphasizes preparedness through actions such as contingency planning and EWS. The law has however been criticised for its weak definition of the roles and responsibilities of various government departments and agencies. The law is also considered outdated in the way that there is space to strengthen the proactive features of the legislation, clarify procedures and rules of engagement, reinforce disaster management institutions, and integrate disaster prevention and mitigation into national and local social development planning. A new law that tackles some of these issues has hence been drafted but is still awaiting approval by the parliament and the government.[80]

In March 2006 the government approved a 10-year Master Plan for the Prevention and Mitigation of Natural Disasters (Plano Director de Prevenção e Mitigação das Calamidades Naturais). This master plan is an ambitious, widespread, multisectoral program of actions directed to reduce populations' vulnerability to natural disasters. The plan among other things envisages reforestation, new water reservoirs, development in irrigation, the introduction of drought-tolerant crops, the fine-scale mapping of disaster areas, an increase in the number of weather tracking stations and monitoring stations and enchantment of EWS and disaster management information systems.[81]

The master plan focuses on communications, information management, and coordination in the response to disasters. Particularly, it recognizes that large areas of Mozambique are not covered by reliable and capable communications networks, that no consistent disaster information management system exists, and that an improvement of the coordination among actors during disaster response needs to be arranged. The master plan therefore calls for priority for disaster-prone areas during the expansion of communication networks. It foresees detailed mapping of flood areas and cyclone zones, disaster-conscious urban planning and more coherent use of scientific data and computers in weather forecasting, the modelling of rivers, and strengthening of early warning systems. The plan recommends an improved definition of the various levels of emergencies, the formation of clear procedures between the agencies involved, the establishment of rules and incentives for private sector participation in

[80] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 188.
[81] Ibid. p, 189.

emergency response, the preparation of inventories of the infrastructure and resources available during catastrophes, and the formation of mechanisms for information sharing. Resource and multiuse centers where local inhabitants can participate in collecting and processing data, monitoring statistics and other disaster-related information are envisaged. Through these centers ideas and experiences about disaster management practices could be exchanged.[82]

Because of resource constraints the majority of these initiatives has not yet been undertaken and could also be expected to be slow in materializing. Some steps have however been taken, the Mozambican government has for example established The National Emergency Operations Center (Centro Nacional Operativo de Emergência, CENOE) in Maputo which has been described as a positive innovation. CENOE and its branches are intended to act as information connections for coordination and decision making during disasters. Besides the center in Maputo a CENOE branch in Vilankulo and in Caia exists which is situated in the middle of the country and in the North branches are located in Angooche and Nakala.[83]

4.2 Disaster management actors in Mozambique

Several stakeholders are involved in disaster management in Mozambique at the international, national, regional and local levels. The roles and responsibilities of the various agencies involved in disaster management are not specifically defined in legal terms; the existing institutional framework has been described as emerged and developed more or less as a practical solution.[84] The highest authority on national level is the Coordination Council for Disaster Management (Conselho Coordinador de Gestão de Calamidades), which is lead by the prime minister and include several ministers. Throughout calm periods the council has occasional meetings where management issues, evaluations of the situation and policy decisions are made. During disasters the council meets on a regular basis in order to take political decisions, and decide on policy issues, such as whether to announce an international appeal or not. The council also resolves high level coordination obstacles that might have appeared in the course of the disaster response.

[82]Ibid. p, 189.
[83]Ibid. p, 186.

[84]Ibid. p, 190.

The National Institute for Disaster Management (Instituto Nacional de Gestão de Calamidades, or INGC) is in charge of coordinating all governmental and nongovernmental activities in mitigation, disaster prevention and emergency response.

INGC supports local authorities in drafting contingency plans and merging them into a national contingency plan, preparing the contingency budget for disasters, organizing simulations and implementing different measures and policies that are required by the master plan. These could for example be the resource and multiuse centers and the CENOE branches and the formation of disaster information management systems. INGC also coordinates disaster-related activities among stakeholders to promote and participate in EWS, training community risk management committees, organizing seminars and learning events and gathering political support for mitigation and disaster prevention. In times of disasters the INGC provides staff to various coordinating agencies, like the CENOE. They also supply logistic support, facilitate information flow, collect input from stakeholders and outline plans for multisectoral response and reconstruction.[85]

4.3 Early warning systems

Three major types of disasters in Mozambique are being monitored by EWS: droughts, cyclones and floods. The systems each include relevant components like forecasting and detection.

The Technical Secretariat coordinates the early warning system for food security, or drought alert system, for Food Security and Nutrition. This is an interagency coordinating body led by the Ministry of Agriculture and also includes the participation of other organizations such as the WFP, the Famine Early Warning Systems Network of USAID, and NGOs. The foundation of the system is the Vulnerability Assessment Committee. This committee carries out crop and household surveys, analyzes weather and other secondary data and monitors markets to calculate the food security outlook. In contrast to cyclones and floods food insecurity and drought are characteristically slow onset disasters and therefore demands different forms of surveillance than fast disasters.

[85]Ibid. p, 190

The EWS for cyclones is operated by the National Institute of Meteorology (Instituto Nacional de Meteorologia, or INAM). Cyclone forecasting is anything but straightforward. It requires highly developed models that have to be calibrated according to long historical series of meteorological and oceanic data. Over long periods such data are not available for the southwest Indian Ocean, which limits the seasonal forecasts of tropical cyclone activity in the region. Normally, however, cyclones can be detected sufficiently early for tracking. INAM relies on information from a range of meteorological services, including the services of France, the United Kingdom and the United States. Its own radar station in Xai-Xai also provides them with information to forecast the location and the severity of disaster impacts and send out warnings to provincial authorities and the INGC. The cyclone warnings are communicated through a system of flags with different colours that are hung out by volunteers and by radio messages, whistles, drumbeats and megaphones. Numbers 1-5 indicate the severity of the cyclone, where 1 is moderate and 5 is intense. The colours blue, yellow and red show when a cyclone is expected to reach a potentially affected area. Blue means in two days, yellow in one day and red in six hours. Many people are aware of the system but the public still needs to be better educated about the meaning of the colours and numbers.[86]

The most complex of the early warning systems in Mozambique is the one for flooding. The most important actors in the system are the four regional water authorities, the ARAs, in the south, the centre, the Zambezi and in the north - together with the National Directorate of Water, the INAM and the INGC. Daily forecasts, five-day forecasts as well as seasonal and precipitation estimates are prepared by INAM. These estimations are published in bulletins and on a web site. The regional water authorities are in charge of the river and dam monitoring stations and exchange data for water flows with the water authorities in neighbouring countries. When water levels reach alert threshold the regional water authorities' duty is to warn provincial and district authorities, the National Directorate of Water, the INGC and to inform the media.

The ineffective infrastructure for hydrological and meteorological measurement in Mozambique however challenges the possibilities for flood forecasting. The INAM only has

[86]Ibid. p, 200

15 comprehensive weather stations that cover about 25 percent of the country. This could be compared to the much smaller neighbouring country Malawi that has 68 stations. In the same manner the water authorities only have five gauging stations on the Zambezi, which is the biggest river in southern Africa. Measurements are done manually and communicated over the closest available telephone or radio transmitter, which can be quite a few kilometres away. The technical capacity and the infrastructure are with other words inadequate for precise, real-time and short-term flood forecasting. This means that the most common prediction that can be made is that sometime during the flood season a flood most likely will occur in one of the familiar places along the usual rivers. In order to predict the extent, the location or the dates of the flooding more sophisticated methods must be developed. A proper computer-based hydrological model supported by a network of monitoring stations capable of real-time water measurements needs to be created. This network could consist of extensive solid series of historical baseline data, digital elevation models, soil and vegetation information and modern rainfall forecasts.

An appropriate hydrological model only exists for parts of the Limpopo River in the south. However the creation of another model for the Save river is under consideration. A quite basic requirement in flood management called flood zoning is also unsatisfactory in Mozambique and has not become more detailed than the general identification of areas prone to flooding.

The information that warns for flooding is communicated by provincial authorities to district authorities that notify community leaders in a straight line or through volunteers, NGOs or local risk management committees. Radio is used to broadcast public warning messages. This does not however necessary mean that the public act on the warnings. People have a tendency not to leave until they are convinced the flood will occur, which often is after the water has affected them. Precise forecasts are therefore important because every time a prediction is inaccurate this damages the credibility of warnings in general. In order to strengthen the implementation of the flood warning system INGC is promoting a people-centred system. This warning system with a clear community involvement has been successfully piloted along the Buzi River and now serves as a model for their continuous work. This system is based on local people measuring the river themselves, combined with their own traditional ways of

anticipating an imminent flood and warning neighbouring citizens downstream. This is the system that is being implemented in Mozambique nation wide.[87]

4.4. Stakeholder involvement?

INGCs 10-year Master Plan for the Prevention and Mitigation of Natural Disasters gives some general directions for the implementation strategy of the disaster risk management in its entirety including flood EWS. In the Master Plan a 'logic of stakeholder involvement' could be found and elements that could be tied to the stakeholder involved model are present for example in passages as this:

'...the implementation strategy shall be based on
(i) the construction of a self-confidence attitude of the communities and authorities, (ii) community participation, (iii) adequate institutional arrangement and (iv) inevitable need to strengthen the district capacities…'[88]

That the implementation strategy shall be based on community participation could be interpreted as a positive attitude towards stakeholder's involvement in the implementation process. An ambition to involve different stakeholders is also present in the document in other passages:

'INGC wants to adopt the decentralization practice (according to LOLE – Law for Local State Administration) so that the communities, local authorities and civil society are engaged in:

- Gathering and processing of information related with the natural disasters;
- Research and development of appropriate technologies that help on the reduction of vulnerability;
- Collective management of risk associated with natural disasters;
- Exchange of experiences between individuals of the community and between different communities;
- Exchange of experiences between districts and provinces;'[89]

[87] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 201
[88] Master Plan for Prevention and Mitigation of Natural Disasters p. 25

[89] Master Plan for Prevention and Mitigation of Natural Disasters p. 26

This passage shows an ambition to involve communities in the warning systems by gathering and processing information related to natural disasters, for example floods. The section also draws attention to the exchange of experiences which is in line with a stakeholder involved model in terms of local population involvement. This includes the idea that responses from people who have previously been affected by floods should be included in the process. Similar elements are recurring in other sections of the document:

'• Identify measurement indicators and methodologies used locally by the communities or by individuals to forecast natural disasters such as droughts, floods, cyclones, etc;
• Combine those indicators with the ones of universal and modern knowledge to produce a new and more credible way of anticipating the disasters;
• Identify ways and means used locally to mitigate the effects of natural disasters;
• Identify, develop and improve local ways of human solidarity in cases of suffering caused by disasters;
• Show to communities the scientific and technological ways of forecasting how the weather forecast is done and the monitoring of the cyclones and floods;' [90]

This statement shows that local knowledge from people who have been hit by floods in the past is declared a prioritized concern, which goes in line with the stakeholder involved model.

*'*Knowledge and technology innovation is not only the prerogative of scientists and academics. It shall be inclusive of communities in general and small producers in particular... '[91]

So the Master Plan for the Prevention and Mitigation of Natural Disasters gives us some insight as to the implementation methods of flood EWS in Mozambique and implies that the use of stakeholder involving methods is an ambition.

4.5 How have the EWS been tested?

It should be made clear that it was not lack of information that made the floods of 2000 so severe in Mozambique; it was rather the lack of communicating the information. Experts were aware that the strong rainfall that had occurred for many days as a result of cyclones would

[90] Master Plan for Prevention and Mitigation of Natural Disasters p. 26
[91] Master Plan for Prevention and Mitigation of Natural Disasters p. 33

result in serious flooding, of a magnitude never before experienced. The warning, however, only reached a few communities, and many of them lacked electricity or radio. Some that did receive the warning did still not evacuate.[92]

One of the reasons was that people in the Limpopo River basin had previously been able to successfully predict floods by observing ants. Since ants build their homes underground they leave their nests when groundwater rises. On this occasion, however, the flood came so fast that there was no time for the groundwater to rise or for the ants to react before the river overflowed. The local chiefs did not believe the early warning that came from the experts because since the time of their ancestors floods had only occurred after ants left their homes. Why should they listen to a stranger and evacuate the whole village at once when the ants had not yet moved? As in most of the Limpopo Valley, many people did not evacuate and more than 700 died. Traditional practice could still be very valuable when developing flood EWS. However in more and more areas it is becoming increasingly unreliable because past knowledge does not necessarily apply to present and future risks. The establishment of long-term dialogue with communities where interaction between past knowledge and the explicitly addressed changes in risk has been hailed as a way of render more effective short-term early warnings.[93]

How the flooding in 2007 and 2008 was handled compared to earlier incidents in the country has widely been perceived as a huge improvement. The strong role of the government when it comes to coordination has in particular been hailed as an important factor. But there have also been advances across all stages in disaster risk management where the death toll dropped significantly.[94] The effectiveness of the flood EWS that had been established, and its link to early action at community level, has been highlighted as an explanation of this development.[95]

That the population's vulnerability for floods has been reduced thanks to the flood EWS is underscored when describing the development in Mozambique and is one of the major explanations to why the implementation of flood EWS is considered a success story in the

[92] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross p. 79.

[93] Ibid. p, 79.
[94] Amin, S. & Goldstein, M. 2008. *Data Against Natural Disasters,* World Bank. p, 185

[95] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross. p 7.

donor community.[96] The fact that the numbers of deaths caused by floods has declined from 800 in 2000 to 30 in 2007 and six in 2008 is figures that strengthen the picture that the flood EWS in Mozambique is well accomplished.[97] It has been concluded that more people would have lost their lives in 2007 and 2008 if it had not been for the alert that could be sent out due to the flood EWS.[98] This development seems to be the main reason the implementation of flood EWS in Mozambique so often is portrayed as a success within the donor community.

5. Findings

In this chapter the results of the informant interviews are presented and analysed. The presentations of the correspondence are discussed and show some of the general difficulties and obstacles with the realisation of the study. As described in section 4.3, the flood EWS is an important element in Mozambique's disaster management. It however remains a part of a larger system, and before the study it was known that a stakeholder involving approach had been claimed in the documents describing the implementation procedure.[99]

5.1 Mapping of actors within flood EWS in Mozambique

The first research question is *"which stakeholders within the field of flood early warning systems exists in Mozambique?"* To answer this question all my informants have been given the following question: *Which are the main stakeholders in the field of early warning for flooding?* And the follow up question: *Are there any other stakeholders besides these?*[100]

Some of the stakeholders were known to us before the study and these also kept returning in the material. The National Institute for meteorology, INAM, The National Institute for Disaster Management, INGC, The National Emergency Operations Center, CENOE and The National Directorate of Water, DNA, this quotation is a characteristic answer to the question above:

[96] GTZ- Disaster Management Along the Rio Buzi, 2005.
[97] World Disasters Report 2009 - Focus on early warning, early action, International Federation of the Red Cross p 11
[98] Red Cross 2007- Emergency Appeal Mozambique:floods can be viewed at: http://reliefweb.int/sites/reliefweb.int/files/resources/F8EC4C7DE964651DC1257345004C7ADB-Full_Report.pdf
[99] Master Plan for Prevention and Mitigation of Natural Disasters
[100] Appendix 2. p, 57.

At the national level we have INGC as the coordination body for disaster management, We have INAM and we have DNA so on the national level there are these three it could further be broken down to regional level where there are directorates within DNA the Aras which are stakeholders too. Then if you go further down to the local authorities also have a role to play in this by facilitating the movement of information and also have a role in responding when an alert has been identified and a warning level has been reached. There is the community of course and especially in the community the risk management committees even in areas where there are not currently a disaster risk management committee we foresee training of local committees to be the one who shall coordinate the response and coordinate the maintenance of the EWS itself. Interview 9

The collected answers are summarized below in a list of stakeholders that are active in the field of flood EWS in Mozambique.

A summary of Mozambican institutions and organisations within flood EWS

All the members represented in the technical council of disaster management, CTGC
CENOE
District governments
EDM (Electricidade de Mocambique)
Eduardo Mondlande University
FUSENET
INGC
The local governments
Local river basin committees/ disaster management committees
The Media, TV, Radio, newspapers
Ministry of agriculture
Ministry of environment
Ministry of health
The National authorities for water (regional), ARAs
The National directorate for water, DNA
The National Institute for meteorology, INAM.
The population
UNAPROC, civil protection

International organisations

International governments

GTZ
UNDP
The UN system
USAid
WFP
The World Bank

NGOs
Civil Society: all national NGOs represented by the G20
INTERMONOXFAM
OICOS
Red Cross
WELT HUNGER HILFE

This list shows that a vast number of stakeholders are, by my interviewees, considered to be a part of the flood EWS in Mozambique, and not only the actors that were known before the field work.[101] This result could have several explanations. The fact that more NGOs are apparent in this list compared to earlier assessments could for instance be related to that these NGOs have become more disaster orientated. NGOs dealing with food security issues have for example gained insight that this cannot be seen as a separate matter. Involvement in disaster risk reduction projects, such as flood EWS, has become of higher interest for these organizations.

That the number of stakeholders assembled in this study is higher than indicated in earlier assessments is interesting - and supports the idea that the ambition of a stakeholder involving approach described in the master plan exists. Another possible result could have been that the relationship between intent and outputs could be more complex, and that the ambition of stakeholder involvement was rather a way of making a political point to gain popularity among voters/donors, but has little impact in the actual implementation. The results from the mapping, however, suggest otherwise. That makes the following interviews with involved actors even more relevant since they can give more detailed knowledge on the issue.

[101] See Chapter 4.2

5.2 Objectives

The objectives of the EWS for flooding refer to what the flood EWS should achieve. According to the presentation of the two ideal types, a system that provides information for floods where the hazard itself is emphasized could be categorised as close to the ideal type for a linear model. A system were a clear community involvement can be tailored to the specific local conditions, on the other hand, is close to the ideal type of a stakeholder involved model.[102]

The answers from the informants varied between being close to the stakeholder involved model or unclear.

> The role is important... and what we are trying to do is those early warning systems that we have we train it to local people. We are training local communities so that they can understand these warning systems and what they mean. Like if the floods are coming they know they can see if the water is high compared to yesterday. And they have to pass the message on; they let people know in time. (Interview 2)

By underlining that the flood EWS should warn people and that local communities should be educated to better understand the systems this quotation implies that the EWS the informant is describing bears a resemblance to the stakeholder involved model since community participation is emphasized. Other informants share this view:

> It is not just information from hydrology systems or infraservice it is also people communicating between each other, and then evacuation. All these things that has been done, communication and also if necessary registration of damage and so on. It's all in the system and this is better managed if decentralised by the administrator and heads of the local government. (Interview 3)

This quote shows that the EWS the informant is portraying consists of something more than providing information for floods where the hazard itself is emphasized. The description of people communicating with each other indicates a more people-centered approach, which goes in line with the stakeholder involved model. Another informant explains what a flood EWS should achieve like this:

[102] See the analytical scheme p.17

…an early warning system that is community based that alerts the community to monitor river levels to monitor rainfall levels and to be in a position to gather information not just for themselves put also to pass the information on. Sometimes they need to some degree to manage their own risk but also be a part of the information exchange structure that contributes to larger risk response efforts in case of a severe event. (Interview 9)

This description also put emphasis on the idea that the community should be involved in the warning system and could therefore be considered closer to the stakeholder involved model. Other answers were harder to clearly place closer to either of the ideal types:

In my opinion EWS should avoid the death and injuries of people at the community level that is the first goal that we are trying to reach. That is what we want to reach by disseminating the EWS at community level. Because we believe that this can really avoid and reduce the impact of disasters at the community level. That's how we see it. (Interview 7)

This answer reveals an overarching goal of the EWS for flooding that could be found in both the linear model and the stakeholder involved model, but does not tell which way the informant believe that the system has been implemented, and thus makes it difficult to place it closer to either of the ideal models.

To sum up, the answers point to the notion that the objectives for what the Mozambican flood EWS should achieve are more in line with what a people-centred warning system - with a community involvement - should accomplish than a system where the hazard itself is emphasized. Some answers fall between the two ideal types. The ones that can be classified lead to the conclusion that the objectives are categorized as closer to the ideal type for a stakeholder involved model than the ideal type for a linear model. See figure 3 below for a visual figure.

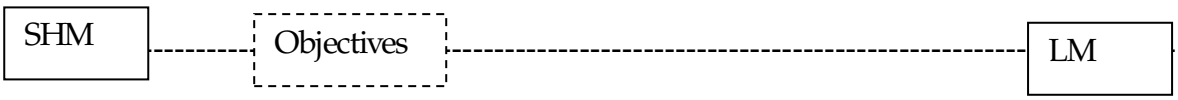

Figure 3. Objectives

5.3 Overall involvement

The second category considered in the informant interviews were the overall involvement referring to how the stakeholders should be involved in the implementation process. According to the created ideal types, a linear model advocates that the responsibility for the implementation and its success is the responsibility of the liable institution, and that other stakeholders should not be involved. A stakeholder involving approach on the other hand, as the name indicates, is positive to the involvement of stakeholders. The likelihood of a successful implementation is in this model considered to be higher if all relevant stakeholders are involved.[103]

The answers concerning this category were close to the ideal type for a stakeholder involved model and showed no signs that bear resemblance to the linear model.

... the implementation of Early Warning Systems and the involvement with traditional leaders in issues connected with disaster the involvement of local authorities like district governments the implementation of a coordination mechanism as national, provincial and district level which stakeholders can be part of and give their input. (Interview 7)

This quote shows an understanding which means that implementation of EWS for flooding should involve stakeholders and that they shall be given the opportunity to influence the outcome. The stakeholders that are explicitly mentioned are the traditional leaders and local authorities. But the 'coordination mechanism' that is mentioned also leaves room for participation of other stakeholders as well. Other answers suggest that the involved stakeholders include a wider group than the local authorities:

In the CTGC you have representation from civil society you have representatives from the UN-system and all the donors and you have the government institutions and all the technical branches, all of them are there. So there is no way for people not to have information. (Interview 1)

This informant refers to the Disaster Management Technical Council, CTGC, as an example of how different stakeholders are involved in the planning of disaster management in general, and also have an impact on the implementation of flood EWS. Even if the answer does not expose weather, this involving approach leads to a higher likelihood for a successful

[103] See the analytical scheme p.17

implementation or not. It describes an implementation procedure that is involving stakeholders.

I believe that many stakeholders have been involved… And I believe that everyone is happy because you know you have some NGOs acting in some provinces and some in others and they are different. And most of them are controlled by UNDP, the humanitarian side of the partnership. So yeah things are ok… So long as most of the stakeholders are with us, are there and act we are fine. (Interview 2)

This answer implies that several stakeholders have been involved in the implementation process of flood EWS in Mozambique, rather than that the implementation process has been handled solely by the responsible institution itself.

I can say that the involvement is good. Because now we don't have that problem with sharing of information. Because sometimes when we are talking about working groups the big problem is the sharing of information. Now it is possible to contact INAM because they everyday have to provide information to INGC and INGC can share that information with all the stakeholders. And they can use that information and go to the CTGC and share that information so I think the communication is good. We had the problem in the past but now we are ahead of the coordination system. (Interview 8)

This description is in line with the concept that an involvement of all relevant stakeholders increases the likelihood of a successful implementation.

In summary the picture of the overall involvement that is visualized in these answers shows an approach that is positive to the involvement of relevant stakeholders in the implementation process of flood EWS in Mozambique and thus also the stakeholder involved ideal type. See figure 4 for a visual figure.

Figure 4. Overall involvement.

5.4 Involvement of local populations

The third category that the informants were asked questions about was the involvement of local populations: how have the local populations in disaster areas been involved in the shaping of the Mozambican flood EWS? The description of the two ideal types show that if the involvement of the local population is a question that is not prioritized it is close to the ideal type for the linear model. If local knowledge about responses from people that have experienced floods in the past are included in the process and this is a prioritized area the implementation is close to the stakeholder involved model.[104]

The actual design of the project in the beginning of the implementation gathering information was done discussing with local authorities and community level there is a detail survey done among the community to understand their awareness of the risk their understanding of warning and what an early warning system could be. Their knowledge of specifics of the river… then among the community there are local risk management committees who identify areas and also community leaders and district officials also have identified people in the community and those are the people who are involved in the day to day collection information for example monitoring the water levels. So it is really community based approach. Interview 9

In this case the inclusion of local knowledge in the implementation process is described as a prioritized matter. The description of the surveys indicates an interest for gathering information about the local populations experience and understanding of the risks with flooding.

I believe they are there… this problem does not affect us as such if I am sitting in my office. But it affects them so they should be involved, they should be working with it and knowing what to do when this flood is happening. So yes we try to involve them, we try to teach them, to capacitate them, and do whatever they need. We try to do everything what they need… Interview 2

This answer gives the picture that the informant believes that the local populations are involved in the shaping of the flood EWS. The argument for their participation is that they are the ones that are being affected.

…for floods was is used is a system of sticks in the river and all the local disaster risk committees has a person that is responsible to assess how the river is behaving in the community and after that provide this information to all the members of the community which are the steps that they should take in order to be prepared or take because of this situation. In this sense I think that is a quite participative process because the responsibility is within the community. Interview 7

[104] See the analytical scheme p.17

This informant gives a description of a system were the local population is involved in a participatory manner and further explains how this process is carried out and how the local population is involved:

…the community are the one that select the members of the disaster management committees and they also select the responsible role of each member of the committees. They are chosen through traditional leaders, they select and present it to the community. The role of the early warning person is basically based on their experience of flood situation or cyclones that affect the region. So they are involved in this case. The Early warning systems person is the one who is going to go back to them and give them information about the floods so that is basically how they are involved. Not in the selection of the system as such but they appoint the person that is responsible to give them the information about the flood situation. Interview 7

This quotation shows a more detailed description of how the local knowledge and experience of floods have been included in the implementation of the warning systems for flooding. Another informant puts comes with a similar explanation although a little more concise.

…we have these local management committees based on the population living in that area. They do sensitisation and committees are involved in simulations basically that is it. (Interview 8)

To sum up the answers imply that the involvement of the local population and their knowledge about responses and risks seem to be a prioritized area and also therefore close to the stakeholder involved model. See image 6 below for a visual figure.

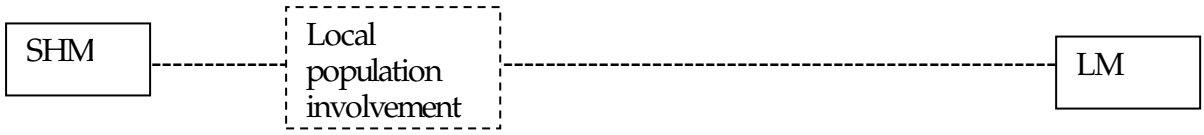

Figure. 5 Local population involvement

5.5 Causality

The fourth and final category that the informants were asked questions about was causality, what explains the outcome, success or lack of success, of the EWS implementation? A description close to the linear model would claim that the institutional capacity together with strength and amount of political will explain how successful an implementation turns out to

be. An explanation closer to the stakeholder involved model would put emphasis on a multi-level stakeholder involvement including both financing and developing agencies as well as the groups that will be affected and are likely to take action in case of extreme incidents.[105]

The answers shifted between being close to the ideal type for a stakeholder involved model and being close to the linear model type, while some answers were hard to categorise.

… the way that INGC work is that they try to work in a really participatory manner, they let other stakeholders and NGOs collaborate and give their ideas and improve their work. The INGC even though it's a government institution they try to work as a NGO they try to be a bit flexible and really accept the ideas and improvements that stakeholders are giving to them: UN-agencies, CVM [Mozambican Red Cross] etc. they let them work together and give them ideas about how to work in emergency and disaster situations. And how they together can improve the response in terms of disaster… Interview 7

By specifying that INGC uses a participatory and flexible approach and makes an effort to collaborate with stakeholders and NGOs to improve their work this answer describes an implementation that could be categorised as close to the stakeholder involved model. Other quotations also contain similar descriptions of what explains the outcome of the EWS implementation.

The exchange of the structure of the directorate where younger persons who are interested and a openness to advice what other countries have done... They saw a good management structure and wondered why? How? And so on. It has been an openness to understand what have been done in other countries. Interview 3

This answer implies that an open mind towards how other countries have implemented their EWS has been present in the Mozambican implementation process and also explains the outcome. This attitude is seen in new personnel being involved in carrying out the operation. The involvement and openness ties this quote closer to the stakeholder involved model than the linear one.

The early warning system we call it a system because there are many components in early warning so the principal components to produce information here in Mozambique is first of INAM, the second one is the water authorities DNA, and also people of seismology because of earthquakes, tsunamis etc and then we also have the problem of food security. Those are the providers of information they are the sources of information to the early

[105] See the analytical scheme p.17

warning systems and are the key actors for the early warning systems. So to build the capacity for those institutions we need of course strong cooperation with many other partners. Interview 6

The explanation that an EWS consists of several components, and that cooperation with other partners can help to reinforce these systems fits with the ideal type for a stakeholder involved model. The involvement of agencies or organizations that will finance the development and operation of the system is within this model seen as explanatory to the outcome of the implementation of EWS.

Human resources, financial resources because to do early warning it might sometimes look like it is cheap but sometimes it is not cheap because you have to find very nice computers you need skilled people if you want to run one model. We are talking about a country that is very poor and all the resources are situated here in Maputo that is another big problem. The data from the field and the resource problem like human resources financial resources etc. Interview 8

This answer underlines the limitations of the institutional capacity in regards to human and financial resources as a factor that explains the outcome of the EWS implementation. This citation accordingly could be categorised as close to the ideal type for the linear model.

…funds is a problem, sometimes there is a limitation. Funds and human resources but even so we are trying to do our best to have everything going the way we want it to go. …the will of changing and government is there. Because most things in a country does not work out if politicians do not accept these things as their problems. But if the government is willing to solve, the government is willing to develop with the people, the government is willing to do something to change. That is the good reason; I believe that's why we have this success story, because the government has been involved. Interview 2

Describing funding as a problem could be interpreted as the institutional capacity and strength being one of the explanatory factors behind the outcome of the EWS implementation. The governments' motivation to resolve the situation is also highlighted in this answer, and this is in line with the explanation that the amount of political will explains the outcome of the EWS implementation.

These answers contain elements that could be connected with both the ideal type for the linear model and the ideal type for a stakeholder involved model.

Since elements from both the ideal types and some answers that fall between them are found it is harder to determine whether the answers related to this category should be classified as closer to the ideal type for a stakeholder involved model or the ideal type for linear model than in the evaluation of the other categories. Since the category includes elements from both ideal types it is therefore estimated to land between the two ideal types. See figure 6 for a visual figure.

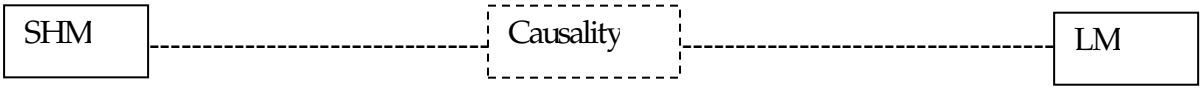

Figure 6. Causality

6. Conclusions

The first research question concerned the dimensions of stakeholders engaged within the field of flood EWS in Mozambique. The data provided by this study resulted in a comprehensive list of stakeholders that my interviewees considered to be a part of the flood EWS in Mozambique. This list included several actors that were not known to us before the field work. That the number of stakeholders assembled in this study is higher than indicated in earlier assessments is interesting in the sense that it supports the idea that the ambition of a stakeholder involving approach described in the master plan does exist. The manifoldness of stakeholders suggests that a stakeholder approach does seem to be used in Mozambique and is not merely a political gesture to satisfy voters and donors.

The second research question, if elements from the stakeholder involving implementation model could be found in the case of implementation of flood early warning systems in Mozambique, was answered with guidance from the analytical tool elaborated in this study. Since before we knew that stakeholder involving ambitions had been outlined in the Master Plan for the Prevention and Mitigation of Natural Disasters and that this had been confirmed to a certain level by the mapping of actors. The data provided from the informant interviews however more systematically supported the existence of a stakeholder involving approach in the implementation process. This relation was most visible related to the categories ‘overall

involvement', 'local population involvement' as well as concerning 'objectives'. When it comes to the category 'causality' elements that could be tied to a stakeholder involved approach was found too, but also statements that corresponded to the linear implementation model. All together however, the ideas and statements that correspond to the linear implementation model did not permeate the material to the same extent as the ones related to a stakeholder involved model.

The results show that an inclusive stakeholder involving approach could be found in the successful Mozambican case, and that the policies that praise stakeholder involvement as an important factor to attain a successful outcome when implementing EWS for natural hazards in this sense is strengthen.

The thesis third research question is related to in what way the potential stakeholder involving methods in the Mozambican case could help explain the successful implementation of flood EWS. To answer this question the final category in the analytical scheme called 'causality' becomes of special interest. It was in this category that elements from both the ideal types were found which indicates that Mozambique is not a clear cut case of the stakeholder involved model. The answers close to a stakeholder involving model can however give us some insight of how this approach could help to explain the positive outcome in Mozambique. The condensed answers in this category imply that an open mind and a participatory and flexible approach from the INGC has had an impact on the risk management in Mozambique and also the implementation of flood EWS.The data shows that the relationship between the key actor INGC and the other involved stakeholders seem to be an important piece that can help to explain the successful implementation in Mozambique.

A different outcome than the one that reveals itself in the interview material is far from unthinkable: even if a genuine ambition and will of attaining stakeholder involvement and people-centered approaches were at hand, a firmly rooted distrust between the key actor and the stakeholders could obstruct the actual involvement. In the Mozambican case the way INGC has handled the stakeholder involvement seem to be a factor that could help explain the successful implementation. INGCs attitude towards stakeholder involvement and treatment of people-centered approaches combined with an openness to understand new perspectives seems to be important in creating strong cooperation with other partners, and this appears to have facilitated the implementation of flood EWS in Mozambique.

This study shows that involvement of stakeholders and the use of people-centered approaches that have been applauded within the policy field of implementation in developing countries and EWS for natural hazards as well as highlighted in the research fields of EWS is present in the Mozambican case. This approach can also to some extent be regarded as one explanatory factor related to the resulted implementation; it does not however give us a complete explanation to the outcomes in this case. There are other possible reasons why the flood EWS has been successful in Mozambique. For example the floods of 2000 had severe impacts on the country and the public support and awareness is as mentioned in section 2.1 often high closely after a disaster event and this can facilitate the introduction of secure EWS. The results of this study nonetheless indicate that the assumption that stakeholder involvement and people-centered approaches are procedures that impact implementation outcomes positively is not contradicted.

This study could be seen as an initial indicator that suggests that the use of stakeholder involvement and people-centered approaches should not lose their present prominent position within the policy community.

That the primary source for this research comes from informants that to a large extent also are responsible for the implementation of flood EWS in Mozambique is something to be cautious of and to bear in mind when using this study's results. Several informants have been interviewed and any systematic skewness could not be found in their answers.

7. Discussion

Even though some caution should be kept in mind regarding alternative influences on the implementation of flood EWS and considering the need of further research to assess the influence of a stakeholder involved model this approach as well as INGCs attitude and treatment of this method and strategy has shown to be an important piece of the implementation process in Mozambique and can help to give some answers to the successful outcome.

The information provided from this study could help to guide the way for future policies concerning flood EWS and its implementation by proposing that stakeholder involvement and

people-centered approaches should be a relevant part of such guidelines. This study suggests that stakeholder involvement seems to be a central piece in the lines of how earlier research has portrayed it concerning policy implementations in developing countries and implementation in other EWS fields than flood EWS. This study also suggests that the attitude and treatment of stakeholder involving strategies and people centered methods from of a key actor, in this case INGC, seem to be of noticeable importance when creating relationships with other involved stakeholders. These pieces are elements that should be highlighted in future research and also could play an important part in potential future successful implementations of flood EWS.

In order to improve the ideal types for future potential research a short reflection is however needed. The ideal types were helpful to describe the implementation of flood EWS in Mozambique. Insights were nevertheless gained during the process of interviewing informants and analyzing the data concerning how the ideal types could be adjusted to better understand the implementation practices. For example a new category that measures a top-down or a bottom-up perspective could be of use.

8. Future research

To validate this study the analytical tool could be used in other contexts. This would compare the results in this thesis with other contexts, for example other flood-prone countries were the implementation of flood EWS has also been successful or have failed. It would shed some light on whether stakeholder involving and people-centered approaches are as present (or absent) in these cases.

Since one of the factors that this study considers as a potential explanation to success concerning implementation of flood EWS is the relationship between the key actor and other stakeholders it consequently becomes of interest to gain more knowledge of how INGC have managed to gain the trust and the position they seem to have in Mozambican society. Further research concerning INGCs attitude and treatment of stakeholder involvement could give more detailed knowledge on this issue.

In view of the fact that this research has been based on material from actors that have been immediately involved in the implementation process such as national institutions NGOs etc it

would also be interesting to compare these results with the views of local populations for instance. As mentioned in the method chapter this would indeed put the theory to a tougher test. Based on interview material from this group would the categorisation of the level of stakeholder involvement been any different?

A related question is also whether a successful implementation of early warning systems goes along with the creation of a resilient society, and what does a system need to be established as successful? It helps people to save the lives of people living in risk zones but does it help to create long-term solutions? If not, could it still be viewed as 'successful'?

How the flood EWS are connected to the other warning systems in Mozambique is furthermore highly relevant to examine in order to get a grasp of the disaster risk management in whole.

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10 Appendices

10.1 Appendix 1. Letter to stakeholders

Dear X,

I got your contact details from X. I am a Master's student from Gothenburg's University, Sweden and until the end of March I am carrying out research in Maputo. I am currently writing my Master's thesis funded by a Swedish scholarship which broadly aims to understand the Early Warning Systems for flooding in Mozambique. I am contacting you because I am hoping that you will be able to participate in an interview concerning your organisation/institutions involvement in the implementation of EWS for flooding in Mozambique.

I hope that you will have the time to share with me the knowledge and experience about the work with EWS for flooding from your organisation/institutions point of view. Your participation would be very valuable for my thesis project.

The interview will take approximately one hour. If you can meet with me for an interview, you can of course chose a day and time that fits your schedule. I will be in Maputo until the end of March, so I am happy to meet you for an interview any time before then.

I will follow up on this email next week. If you have any questions or wish to contact me or my supervisor, our contact information are listed below.

Kind Regards,

Patrik Klingberg
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10.2 Appendix 2. Interview guide

Hello my name is Patrik Klingberg and I am a Swedish political science student at the master's level. Through a Swedish scholarship I have been given the opportunity to study the implementation of flood Early Warning Systems in Mozambique.
Is there anything you wonder at or want me to know about you before we start the interview?

Theme 1: Place of work, colleagues and organisation

1. **First I would like to know more about your work. What are your usual tasks? Which matters do you handle?**

Theme 2: The Mozambican disaster management

Can you shortly describe your organization/institutions role in Mozambique's disaster management?
How does your organization carry out your tasks?
Can you say something about how the disaster management in Mozambique has developed since 2007?

Theme 3: The Early Warning Systems for flooding in Mozambique

1. **Who took the initiative to create an flood EWS in Mozambique?**
2. **What role do the flood EWS have in Mozambique's disaster management?**
3. **What should the flood EWS achieve in Mozambique?**
4. **Which are the main stakeholders in the field of early warning for flooding?**
5. **Are there any other stakeholders besides these?**
6. **How would you describe the implementation of flood EWS in Mozambique?**
7. **Which have been the main obstacles for the implementation of flood EWS?**
8. **What interventions (e.g. evacuations of villages etc) have been implemented?**
9. **To whom will these interventions be communicated?**
10. **How have the EWS for flooding been used?**

Theme 4: Stakeholders involvement

1. **How would you describe that the involvement of different stakeholders interests has been in the implementation process of flood EWS?**
2. **How are the procedures formed between the involved agencies?**
3. **How have the inhabitants in disaster prone areas been involved in the shaping of the early warning systems?**
4. **Why is Mozambique's disaster risk management often portrayed as a success story?**

Closing questions
Is there anything else you would like to include or bring up?
If I need to contact you again, is that ok?

Who else do you recommend that I meet that has knowledge of the implementation of EWS for flooding in Mozambique?