Consideration of environmental issues in post disaster settings - fact or illusion?

An analysis of the Post Disaster Needs Assessment tool with a closer look at the implementation and consideration of environmental aspects

Kilian Hinzpeter, BSc
Master thesis
Eidesstattliche Erklärung

Ich erkläre hiermit an Eides statt durch meine eigenhändige Unterschrift, dass ich die vorliegende Arbeit selbständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel verwendet habe. Alle Stellen, die wörtlich oder inhaltlich den angegebenen Quellen entnommen wurden, sind als solche kenntlich gemacht.

Die vorliegende Arbeit wurde bisher in gleicher oder ähnlicher Form noch nicht als Magister-/Master-/Diplomarbeit/Dissertation eingereicht.

__________________________  __________________________
Datum                                Unterschrift
Abstract

Devastating 'natural disasters' increased in severity and frequency over recent years due to causes like climate change, population growth or land degradation. Heavy rainfalls causing floods or the absence of rain causing droughts are just two examples. If a country cannot cope with the impacts of a 'natural disaster' anymore they can request help from the international disaster management community. Disasters are not just 'natural' but always have a 'man-made' component and therefore the term 'natural disaster' is more complex.

This master thesis deals with the disaster management tool of Post Disaster Needs Assessment (PDNA) developed by United Nations (UN), World Bank (WB) and the European Union (EU). Its aim is to support local governments in figuring out the needs after the 'natural disaster' and to point out the priorities of action. Experts from UN, WB, EU and the local government carry out this assessment and specialists from up to 18 different sub-sectors can work on the final assessment report. The focus of this master thesis is on the sub-sector 'environment', which deals with ecosystems, the services they provide, their degradation and destruction and the post-disaster reconstructions and the recommendations for this sub-sector.

The importance of this topic is the influence of environment on mid and long term rehabilitation of a country or region after a 'natural disaster'. Especially the UN wants to know how environmental aspects are seen by the disaster management community and how the consideration of environment can be changed. Particularly issues like environment get less attention, not only in processes like PDNAs but also in every day life. Therefore the aim of this thesis is to figure out the status of the sub-sector environment and to present potentialities how its implementation can be improved in PDNAs.

For this purpose PDNA reports from 2009-2015 were analysed to assess and evaluate possible factors influencing on the implementation of the sub-sector environment. Based on these results an online questionnaire was developed to get the opinion of people working on different PDNA objects. Last expert interviews were held to get more detailed and insight data on PDNA processes.

The data evaluation shows that even though many experts are aware that the sub-sector environment is important in the PDNA process it still has not the same status as economic-related sub-sectors. Reasons underlying might be the declaration of the sub-sector environment as cross-cutting, the problem of the sub-sector to get figures for intangible damages and
connected to that getting less attention because the effects often only occur in the mid and long term recovery process.

It is also challenging to get local governments to stronger look at environmental issues and other important sub-sectors. As the UN, WB and EU only have an advisory function in the process it is impossible to mandatory implement all sub-sectors needed if a PDNA is done at all. There have been good examples where environmental aspects were stronger taken into account. These assessments could work as models and show countries requesting for a PDNA how crucial the consideration of environmental concerns and also other less considered sub-sectors are in the long term.
Acknowledgements

I would like to thank Univ. Prof. Dr. Martin Coy for his support and helpfulness during my whole master degree and this master thesis.
I would also like to thank Dr. Simone Sandholz for her assistance during the whole master thesis.

A special thanks should also go to Muralee Thummarukudy, who was my contact person at UNEP, for his patience and expertise.
Furthermore I would like to thank Marisol Estrella for her help with the online questionnaire.

Finally I would like to thank my family, girlfriend and friends for their support and help throughout my whole university education.
# Table of contents

**ABSTRACT** .................................................................................................................. I

**ACKNOWLEDGEMENTS** ..................................................................................................... III

**TABLE OF CONTENTS** ........................................................................................................ IV

**LIST OF FIGURES** ............................................................................................................... V

**LIST OF TABLES** ............................................................................................................... VI

**LIST OF ACRONYMS AND ABBREVIATIONS** ..................................................................... VII

1. **INTRODUCTION** ............................................................................................................ 1
   1.1 **OBJECTIVE AND RESEARCH QUESTIONS** ................................................................. 2
   1.2 **STRUCTURE AND SCOPE** ......................................................................................... 3

2. **METHODOLOGY** ............................................................................................................ 4
   2.1 **IN-DEPTH DESK STUDY** .......................................................................................... 4
   2.2 **ONLINE QUESTIONNAIRE** ....................................................................................... 5
   2.3 **EXPERT INTERVIEWS** ............................................................................................... 7
   2.4 **DATA INTEGRATION** .................................................................................................. 8

3. **THE CONCEPT OF RISK** ............................................................................................... 9
   3.1 **SOCIOLOGICAL-CONSTRUCTIVE APPROACHES OF RISK** .................................... 11
   3.2 **TECHNICAL-OBJECTIVE APPROACHES OF RISK** ................................................ 12
   3.3 **GEOGRAPHICAL APPROACHES ON HAZARDS AND RISK** ............................... 13
      3.3.1 **Vulnerability and resilience** ............................................................................... 16
   3.4 **RISK GOVERNANCE** .................................................................................................. 17
   3.5 **RISK MANAGEMENT** ............................................................................................... 20
   3.6 **RISK COMMUNICATION** .......................................................................................... 22
   3.7 **RISK PERCEPTION** ................................................................................................... 23
   3.8 **MODELS AND FRAMEWORKS OF RISK AND LATEST DISCUSSIONS IN HAZARD RISK RESEARCH** ......................................................... 24

4. **GLOBAL HELP AND DISASTER MANAGEMENT** ............................................................. 27
   4.1 **NEED FOR GLOBAL HELP** ...................................................................................... 27
   4.2 **THE HISTORY AND DEVELOPMENT OF DISASTER RESPONSE** ............................ 30
   4.3 **THE DISASTER MANAGEMENT CYCLE** .................................................................... 32
      4.3.1 **Disaster Response** .............................................................................................. 33
      4.3.2 **Disaster Recovery** ................................................................................................ 34
      4.3.3 **Disaster Mitigation** .............................................................................................. 37
      4.3.4 **Disaster Preparedness** .......................................................................................... 40
   4.4 **INTERNATIONAL DISASTER MANAGEMENT** ............................................................ 42
      4.4.1 **Actors in international disaster management and PDNAs** .................................. 43
      4.4.2 **Disaster Assessments** .......................................................................................... 45
   4.5 **POST DISASTER NEEDS ASSESSMENT (PDNA)** .................................................... 47
      4.5.1 **The sub-sector environment** ............................................................................... 53
      4.5.2 **Challenges of the sub-sector environment** ........................................................... 55

5. **PDNA - A TOOL WITH THE ATTEMPT TO PERFECTION: RESULTS AND EVALUATION** .... 58
   5.1 **AN INSIGHT ON INTERNATIONAL DISASTER COMMUNITY AND ‘NATURAL DISASTERS’** .......................................................... 58
   5.2 **POST DISASTER NEEDS ASSESSMENT AND ITS CONSIDERATION IN A DISASTER MANAGEMENT CONTEXT** .............................................. 61
      5.2.1 **Influencing factors for the implementation of PDNAs** ......................................... 72
   5.3 **THE ROLE OF ENVIRONMENT IN POST DISASTER NEEDS ASSESSMENTS** .................. 73
   5.4 **RECOMMENDATIONS FOR ENVIRONMENTAL CONCERNS IN POST DISASTER NEEDS ASSESSMENTS** .................................................. 86

6. **CONCLUSION** ............................................................................................................... 90

**BIBLIOGRAPHY** ............................................................................................................... 93

**ANNEX** .......................................................................................................................... 104
List of Figures

Figure 1: Components of risk (adapted from Thywissen 2006, p.39) ......................................................... 17
Figure 2: The risk governance framework with its five elements (adapted from IRGC 2007, p.6) .......................................................... 19
Figure 3: Global amount of major natural events from 1950-2008 (Munich Re, 2010) ................. 28
Figure 4: Natural disasters worldwide from 1980-2015 (Munich Re 2016) .............................. 29
Figure 5: The disaster management cycle (adapted from Wood, Boruff and Smith 2013, p.150) 33
Figure 6: The ideal disaster recovery cycle (Frerks et al. 1995, p.363) ................................................. 35
Figure 7: Stages in recovery from disasters: (a) for a developing country, (b) for an industrialised nation (Alexander 200, p.4) .................................................................................. 36
Figure 8: Sectors assessed in PDNAs (adapted from UNDG, World Bank, and EU 2013, p.13) .... 49
Figure 9: Post Disaster Needs Assessment Process (adapted from UNDG, World Bank, and EU 2013, p.50) ......................................................................................................................... 52
Figure 10: Ecosystem services (adapted from MEA 2005, VI) ................................................................. 54
Figure 11: Process of disaster management with help of the PDNA tool (own figure) .................. 61
Figure 12: The overall coordination during PDNAs (own figure) ......................................................... 63
Figure 13: Understandability of the PDNA Guidelines Volume B (own figure) .............................. 64
Figure 14: The implementation of PDNA guideline goals/aims (own figure) ................................. 65
Figure 15: Amount of attention given to sub-sectors (own figure) ..................................................... 67
Figure 16: Which sub-sector should be given more attention (in green: sub-sector environment and environment related sub-sectors) (own figure) .................................................................................. 76
Figure 17: Consideration of the sub-sector Environment (own figure) ............................................. 77
Figure 18: The economic perspective of environmental concerns (own figure) ............................. 79
Figure 19: The contribution of each sub-sector to sustainable recovery (own figure) .................. 80
Figure 20: Importance of sectors (own figure) ...................................................................................... 82
Figure 21: Environment as a stand alone sub-sector (own figure) ..................................................... 83
Figure 22: Cooperation between the sub-sector environment and other sub-sectors (own figure) ................................................................................................................................. 84
Figure 23: Cross-cutting status and the impediment in the consideration of PDNAs (own figure) ................................................................................................................................. 85
Figure 24: Recommendations how the relevance of environment could change (own figure) .... 89
List of Tables

Table 1: PDNA reports used for analysis (own table) ................................................................. 4
Table 2: List of interviewed persons (own table) ......................................................................... 8
Table 3: Illustrative sample of national and international actors participating in PDNAs (UNDG, World Bank, and EU 2013, p.16) .......................................................................................... 51
Table 4: Environmental drivers of disasters (GFDRR et al. 2013, p.11) ........................................ 55
Table 5: Sectoral integration of environmental issues (GFDRR 2013, p.15) ................................. 57
# List of Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
</tr>
<tr>
<td>AfDB</td>
<td>African Development Bank</td>
</tr>
<tr>
<td>BC</td>
<td>Before Christ</td>
</tr>
<tr>
<td>CDB</td>
<td>Caribbean Development Bank</td>
</tr>
<tr>
<td>DaLa</td>
<td>Damage and Loss Assessment</td>
</tr>
<tr>
<td>DFID</td>
<td>Department For International Development</td>
</tr>
<tr>
<td>ECHO</td>
<td>Directorate General for Humanitarian Aid and Protection</td>
</tr>
<tr>
<td>ENA</td>
<td>Environment PDNA team</td>
</tr>
<tr>
<td>EU</td>
<td>European Union</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
</tr>
<tr>
<td>GFDRR</td>
<td>Global Facility for Disaster Reduction and Recovery</td>
</tr>
<tr>
<td>HRNA</td>
<td>Human Recovery Needs Assessment</td>
</tr>
<tr>
<td>IADB</td>
<td>Inter-American Development Bank</td>
</tr>
<tr>
<td>IDB</td>
<td>Islamic Development Bank</td>
</tr>
<tr>
<td>IDNDR</td>
<td>International Decade for natural disaster Redcution</td>
</tr>
<tr>
<td>IFIS</td>
<td>International Financial Institutions</td>
</tr>
<tr>
<td>IFRC</td>
<td>International Federation of Red Cross and Red Crescent</td>
</tr>
<tr>
<td>ILO</td>
<td>International Labour Organisation</td>
</tr>
<tr>
<td>IMF</td>
<td>International Monetary Fund</td>
</tr>
<tr>
<td>INGO</td>
<td>International Non-Governmental Organisation</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>IRGC</td>
<td>International Risk Governance Council</td>
</tr>
<tr>
<td>ISDR</td>
<td>International Strategy for Disaster Reduction</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organisation</td>
</tr>
<tr>
<td>OCHA</td>
<td>Office for the Coordination of Humanitarian Affairs</td>
</tr>
<tr>
<td>PCNA</td>
<td>Post Conflict Needs Assessment</td>
</tr>
<tr>
<td>PDNA</td>
<td>Post Disaster Needs Assessment</td>
</tr>
<tr>
<td>UN</td>
<td>United Nations</td>
</tr>
<tr>
<td>UNDG</td>
<td>United Nations Development Group</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>UN-ECLAC</td>
<td>UN Economic Commission for Latin America and the Caribbean</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organisation</td>
</tr>
<tr>
<td>UN-HABITAT</td>
<td>United Nations Human Settlements Programme</td>
</tr>
</tbody>
</table>
1. Introduction

At the time of global media age television broadcasting of the destruction caused by 'natural disasters'\(^1\) became nearly ordinarily. It is not just the frequency but also the impact, which increased in recent years. With the support of humanitarian aid and international help countries affected by 'natural disasters' get back to normal faster and more organised (Peters and Deutsches IDNDR-Komitee für Katastrophenvorbeugung 2000). However only these actions would not support the affected country to sustainably recover from a 'natural disaster'. As a consequence the need for a supportive and proceeding tool rose. To help those countries which cannot cope with the damages caused by a 'natural disaster' on their own the international disaster management community developed tools to figure out the needs of a country after a 'natural disaster' and to recommend the local government which priorities to focus on (Coppola 2015).

One of these tools is the Post Disaster Needs Assessment (PDNA) developed since 2008 by the EU, WB and UN. On the basis of other existing assessments this comprehensive and collaborative tool was created which does not only involve national agencies and institutions but also the local government. With the help of PDNA guidelines everyone involved in PDNAs should be able to carry them out in their field of expertise. In 2013, after five years, one overall guideline and 18 sub-sector specific guidelines were finally released. The PDNA Guidelines Volume A outlines the implementation of the whole PDNA process, PDNA Guideline Volume B the one of each sub-sector grouped in productive, infrastructure, social and cross-cutting sub-sectors. This division should bring a clear structure not only for the actors executing the PDNA but also for the donors pledging money to the affected country based on the PDNA report. Having so many different sub-sectors involved also implies that there might be some overlapping, so a well-coordinated cooperation between the sub-sectors is desirable. Some sub-sectors are declared as cross-cutting because they should work together in a multidisciplinary way with other sub-sectors to take up thematic commonalities. This cooperation is required because all cross-cutting sub-sectors are partially influenced by and linked with other sub-sectors.

From this approach the idea rose to examine the sub-sector of environment in this master thesis because it is of such a high importance in disaster management processes. Environment is

---

\(^1\) 'Natural disaster' always means a combination of natural hazard events and man-made triggers. In every case of a disaster there is a natural event which causes the disaster but the effect and impacts on the people is influenced by mankind. Influencing factors are e.g. land degradation, settling in disaster prone areas combined with population growth
globally not only rather neglected on an every day basis but also seems to get less attention in a disaster management context compared to other e.g. economic issues. Therefore it will be analysed whether environmental aspects get less attention in the process of a PDNA and if yes what are the reasons for that. Beyond that it also sheds a light on hindrances for achieving a stronger position for environmental concerns in disaster management general and thus has the potential to provide practical benefits. Finally it also allows for drawing conclusions on a more appropriate consideration of other sub-sectors that do not seem to be considered sufficiently in the PDNA context.

1.1 Objective and research questions

The aim of this master thesis is to analyse how the international disaster management community treats environmental aspects in the implementation and follow-up of PDNAs. It will analyse how environmental themes are considered as well as underlying the reasons. The theoretical background is rooted in the field of geographical risk research that links to disaster management in the way that the perception of several aspects in post disaster settings will change. Especially the environment topic is highly interesting because environmental issues have a main influence how the people's vulnerability and resilience change in relation to a repeating ‘natural disaster’. This brings the hypothesis that if the awareness towards environmental issues would change and the closely related risk perception could be influenced the whole idea of a sustainable recovery with "building back better" could be realised (UNISDR 2015). It is not the aim to criticise the PDNA tool but to question several characteristics in the methodology and the implementation. This approach will be realised on the basis of four research questions, going from general to specific:

1. How does the international disaster management community deal with ‘natural disasters’?
2. Why and how do PDNAs gain consideration in the disaster management context?
3. Which role do environmental concerns play in PDNAs?
4. Which conclusions and recommendations can be drawn regarding the relevance of environmental concerns in post disaster recovery processes?

Data to answer these questions was gathered from literature, the analysis of recent PDNA reports, an online questionnaire send to participants in PDNAs and expert interviews with people from different agencies involved in PDNAs.
1.2 Structure and scope

This master thesis consists of six main chapters. Chapter one introduces the topic of the master thesis and shows the aim and structure of this work. Chapter two presents the research methodology. Chapter three deals with the theoretical background showing the sociological, technical and geographical approaches towards risk. It also gives an overview about different aspects of risk like risk governance, risk management, risk communication and risk perception. The fourth chapter is about global help of the disaster management community. It points out the importance for global help and shows the background and development of disaster response. Further the disaster management cycle with its four phases is presented. Next international disaster management and its actors are specified. Disaster assessments and the specific Post Disaster Needs Assessment (PDNA) are analysed afterwards with a closer look at the sub-sector environment. The data gained will be evaluated in chapter 5 and the research questions will be answered. The last chapter, chapter 6, concludes the thesis and gives an outlook on further research demands in this field.
2. Methodology

The research approach is based on a mix of different quantitative and qualitative methods. It includes literature review and analysis, an in depth desk study of recent PDNAs, an online questionnaire and expert interviews. In the following each method will be described, together with the working process and then the method for the evaluation of the gained data will be explained. Finally the data integration and connection will be presented to make the analysis procedure more comprehensible.

2.1 In-depth desk study

The in depth desk study on recent PDNA reports was done to get a matrix to see possible substantial differences in PDNAs from 2009 to 2015 consisting of 25 PDNA reports. This brings an overview about PDNAs and an analysis on recent reports. The analysis was limited to reports available in English language, thus reports in French were omitted (7 out of 32). The PDNA reports used can be seen in table 1.

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Type of disaster</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>Bhutan</td>
<td>Earthquake</td>
</tr>
<tr>
<td>2009</td>
<td>Cambodia</td>
<td>Cyclone</td>
</tr>
<tr>
<td>2009</td>
<td>Indonesia</td>
<td>Earthquake</td>
</tr>
<tr>
<td>2009</td>
<td>Laos</td>
<td>Cyclone</td>
</tr>
<tr>
<td>2009</td>
<td>Namibia</td>
<td>Flood</td>
</tr>
<tr>
<td>2009</td>
<td>Samoa</td>
<td>Tsunami</td>
</tr>
<tr>
<td>2010</td>
<td>El Salvador</td>
<td>Tropical storm</td>
</tr>
<tr>
<td>2010</td>
<td>Haiti</td>
<td>Earthquake</td>
</tr>
<tr>
<td>2010</td>
<td>Moldova</td>
<td>Flood</td>
</tr>
<tr>
<td>2010</td>
<td>Pakistan</td>
<td>Flood</td>
</tr>
<tr>
<td>2011</td>
<td>Bhutan</td>
<td>Earthquake</td>
</tr>
<tr>
<td>2011</td>
<td>Kenya</td>
<td>Drought</td>
</tr>
<tr>
<td>2011</td>
<td>Laos</td>
<td>Typhoon</td>
</tr>
<tr>
<td>2011</td>
<td>Lesotho</td>
<td>Flood</td>
</tr>
<tr>
<td>2011</td>
<td>Pakistan</td>
<td>Flood</td>
</tr>
<tr>
<td>2011</td>
<td>Thailand</td>
<td>Flood</td>
</tr>
<tr>
<td>2012</td>
<td>Malawi</td>
<td>Flood</td>
</tr>
<tr>
<td>Year</td>
<td>Country</td>
<td>Event</td>
</tr>
<tr>
<td>------</td>
<td>---------------</td>
<td>-------------</td>
</tr>
<tr>
<td>2012</td>
<td>Samoa</td>
<td>Cyclone</td>
</tr>
<tr>
<td>2012</td>
<td>Uganda</td>
<td>Drought</td>
</tr>
<tr>
<td>2013</td>
<td>Fiji</td>
<td>Cyclone</td>
</tr>
<tr>
<td>2013</td>
<td>Nigeria</td>
<td>Flood</td>
</tr>
<tr>
<td>2013</td>
<td>Seychelles</td>
<td>Flood</td>
</tr>
<tr>
<td>2014</td>
<td>Serbia</td>
<td>Flood</td>
</tr>
<tr>
<td>2014</td>
<td>Solomon Islands</td>
<td>Flood</td>
</tr>
<tr>
<td>2015</td>
<td>Nepal</td>
<td>Earthquake</td>
</tr>
</tbody>
</table>

As the report of Lesotho 2011 is not comprehensive it is not considered further in the analysis. At the time the expert interviews were held the last report "Nepal 2015" was published and with that the clean break for the reports used was made. The reports were analysed and classified regarding 12 different aspects which are partially presented in chapter 5.2.1 and fully shown in the final matrix in the annex. After the literature review it turned out that the chosen variables are the best to see whether there are obvious differences influencing the implementation of PDNAs.

### 2.2 Online questionnaire

The second method to gather data is an online questionnaire distributed by using the "survey monkey" platform. This questionnaire was sent to people participating in PDNAs no matter how often, which professional competence or country they are from. The request for the people to fill in the online questionnaire was send via email to 213 people. Overall 40 people responded to the online questionnaire. From these 40 people 29 stated where they were born and they came from 23 different countries. This method was chosen to get the opinion of many people as possible from different fields of competence. The online questionnaire is structured with overall 17 questions about the experience of the people with PDNAs at the beginning followed by the importance of sectors and sub-sectors and the execution of the environmental sub-sector. The last section asked questions about the opinion on PDNAs and about the environmental sub-sector (see annex for the online questionnaire).

The expected goal was to collect information about how the international disaster management community deals with PDNAs and about the status of environment in the process of a PDNA. During the development of the online questionnaire it was tried not to influence the respondents with the way the questions were asked or the order the questions were arranged. The advantages of online questionnaires are guidance of respondents, placing of permissible
values and the filled out questionnaires are already in a digital format. Questions asked can be divided in three different types. Open questions, hybrid questions and closed questions that were all used in the online questionnaire. Open questions want the respondent to write about their experiences, understandings and opinions. Hybrid question give the respondent the opportunity to additional add information to a closed question, whereas closed questions pre structured the answers of the respondents in a multiple choice way which can be analysed quantitatively (Mattissek, Pfaffenbach, and Reuber 2013). Another way of dividing questions is to split them up into four types. The first is the attribute question which tries to establish a profile of the respondent (e.g. age, citizenship status or income bracket). The second is the behaviour question. This type of question tries to find out what people do (e.g. extent of public transport use or recreation habits). The third type of question is the attitude question that aims to discover the people's degree of desirability (e.g. would people pay more tax to improve social welfare services). The last type of question is about belief. What do the people think is true or false will be asked with this type of question (e.g. belief on how important environmental protection is) (McGuirk and O'Neill 2010). In the case of the online questionnaire mainly closed questions were asked because it makes it easy and not time-consuming for the respondent. Special types of closed question were three questions that were a grid/matrix question. For this type of question statements were made and the respondent had to say to what extent they agree with it. Another special type was a rating questions were the respondent had to rank the PDNA sectors. Only two of the 17 questions were open questions not to discourage the respondent and to encourage them to finish the questionnaire.

The data gained in the online questionnaire was analysed in a quantitative way which is to numerically present the empirically gained data. (Schnell, Hill, and Esser 1999). The open questions were also edited in a quantitative way as well to better demonstrate tendencies and not to weight certain statements. The data gained from the online questionnaire was transferred into MS Excel and interpreted with graphs and statistics which you can see in chapter 5 to help answer the research questions. The answers for the open questions were also analysed and flow into the evaluation of this master thesis. A formulation problem occurred regarding three questions. As mentioned later in chapter 4.5 there is a disparity between sub-sectors written down in the PDNA Guideline Volume A and sub-sectors actually existing with an own PDNA Guideline Volume B. For the online questionnaire the sub-sectors from the PDNA Guidelines Volume A were used. The only difference is that there are now only 18 instead of 19 sub-sectors. HIV/AIDS, Age, Energy & Electricity and Nutrition are not used anymore. Instead the sub-sectors macroeconomic impact of disaster and manufacturing were added. The sub-sector transport & telecommunication were split up and are two separate sub-sectors now. This problem will only
slightly affect the outcome of these questions and is not crucial for the results. The sub-sectors of HIV/AIDS and Age will not be listed in the results because no respondent took them into account.

2.3 Expert interviews

The interviews held were all qualitative interviews. The interviews were problem-focused based on a guideline (see e.g. Lamnek 2008). The questions asked are open and semi-structured so the interviewee can answer the questions freely and the interviewer can ask and respond flexible. The structure of the interview was organised in five phases. The order of these phases starts with the explanation where the topic of this master thesis is explained and information about the study were told. Afterwards, during the introduction, the interviewee was told about the scope and structure of the interview. Next, questions for the general exploration were asked with a minimum of restrictions to make the interviewee tell as much information as possible. These questions were general questions about the relation of the interviewee to PDNAs like their task in PDNAs and how often they take part in a PDNA. After that the specific exploration took place if the answers are not precise enough. The interviewer can ask specific questions about the topic and guide the interviewee in the right direction. These specific questions were on the one hand about PDNAs, their implementation and possible restrictions and on the other hand in more detail about the sub-sector environment and issues influencing this sub-sector. After this narrative phase ended the interviewer still had the possibility to ask direct questions. These questions were interview dependent and pursuing interesting issues which came up during the interview (Flick 1995). In this case the interview guideline was built up in three main topics. First general questions about the interviewee in connection to PDNAs were asked followed by specific questions about PDNAs and completed with specific questions on the sub-sector environment.

The interviews were recorded (5 out of 6 due to technical problems), after asking for permission, and due to the wish of some interviewees the data will be presented anonymous. The list of interviewed persons is given in table 2 with the institution of the person, the date of the interview, the lenght of the interview and how the interview was held. Interviews were transcribes afterwards as the basis for the later analysis which happens with the help of coding (Reuber and Pfaffenbach 2005). Coding was done with MAXQDA. Coding has three purposes. "Data reduction organization and the creation of searching aids, and analysis" (Cope 2010, p.283). During coding you read each interview by looking at one specific code and then mark the statement, sentence or passage. In the end you have summarised data about each code (Cope 2010). The interview guideline and the codes used are shown in the annex.
2.4 Data integration

One major task in the data analysis is to integrate the different methods and to evaluate the data comprehensible and problem-orientated. The availability of experts for an interview was restricted. The first step of the data assessment was a detailed literature review to get an overview on the theoretical approaches as well as on the current status of the disaster management theme and especially on the PDNA tool. The in-depth desk study of the recent PDNA reports was necessary to get an idea about factors influencing on the implementation of PDNAs before the interview and online questionnaire was done. The expert interviews and the online questionnaire are a good mix to answer the research questions because both quantitative and qualitative data were obtained allowing for a comparative and more in-depth analysis. They are also supplementary to each other so on the one hand more detailed data can be worked out and on the other hand the opinion of many people can be shown.
The concept of risk

The word origin of risk is very vague. It can be traced back to the Arabs who said "rizq" which means by the trace of god or the given. There is no clear and explicit origin and meaning of the word risk and this ambiguity will continue throughout the understanding of risk and its approaches. The beginning of a society relevant usage of the term risk is traced back to the 12th century connected to the ship trade and the insurance business. Shipping companies wanted to know the risk level of losing freights and ships during long distance trade (Bonss 1995; Japp 2000). Over the centuries the term risk was associated with different actions and events and nowadays the meaning of risk is still ambivalent. In a general context it can refer to a threatening danger, the stake at gambling games, an unexpected 'natural disaster' or a stroke of fate (Weichselgartner, 2002).

Jaeger et al. (2001, p.17) reflect the definition of risk and defined it as "a situation or event in which something of human value (including humans themselves) has been put at stake and where the outcome is uncertain". There are two factors of risk mentioned in this definition: One factor is the event and the other one is the outcome, influencing humans or something else.

The ambiguity of the risk topic derives from basically two main concepts towards it. On the one hand there are the technical-scientific approaches, which see risk as something calculable and predictable (e.g. Alexander 1993; Hewitt 1997). Diametrically on the opposite there are sociological-constructive approaches (e.g. Luhmann 1991; Krimsky and Golding 1992; Banse and Bechmann 1998; Kaspersion and Kaspersion 2005) which see risk as something influenceable and constructible by the people (Luhmann 1991; Müller-Mahn 2007; Renn et al. 2007; Renn 2008c; Löfstedt and Boholm 2009). Due to the high number of research field dealing with risk there are also more detailed subdivided divisions of risk. As Löfstedt and Boholm said "there is no ruling regime of any specific philosophy of science doctrine in risk research, and the field encompasses approaches based on realism, idealism, rationalism, empiricism, methodological individualism and holism"(Löfstedt and Boholm 2009, p.3). The vastness of this topic is also shown by the following examples. Every person is facing several risks in life, e.g. the risk on coronary heart disease coming from air pollution or smoking (Slovic 2001; Cox 2012), the risk in participating in the street traffic (Adams 1995), the risk of being exposed to several natural hazards (Wisner et al. 2004; Glade and Stötter 2008), economic risks (Quiggin 2008) and as a current topic being threatened by terrorism (McFadden, Lyon, and Pinsker 2008).

Weichselgartner (2002) differentiated four different approaches and with that processed the idea of Bechmann (1993) who distinguished up to eleven disciplinary views on risk research.
and Renn (1992) who distinguished seven approaches on risk did a more concrete division of the approaches considering a geographic perspective. Weichselgartner (2002) started with a formal normative approach, which tried to make all types of risk comparable by using one universal risk measure. This idea leads to an objective and acceptable assessment of risk for different situations. The main research object concerning risk is the likelihood of occurrence linked to the expectation of loss, which is stated as an easy equation:

\[
\text{Risk} = \text{Expectation of loss} \times \text{Likelihood of occurrence}
\]

(Weichselgartner 2002, p. 25)

The formal calculated and accepted risk however turned out not to comply with the risk perception of the people and the community (Weichselgartner 2002).

The second approach of Weichselgartner picks up this problem of the disparity between the subjective and objective risk. This psychological cognitive approach tries to empirically determine the decision-making behaviour of individuals or certain groups during risk situations. Connected with that risk perception, risk assessment and risk acceptance turned out also to be important during this master thesis.

The cultural sociological approach of risk seeks to answer why certain views and opinions on risk push through at specific social groups. The focus is on both social groups and individuals. Concerning the technical risk assessment the individual evaluation of risk has a lesser role then the social opinion on risk.

The fourth approach from Weichselgartner tries to combine the natural and social systems to a geographical natural-spatial approach. This idea will be picked up later in this chapter (Renn 1992; Bechmann 1993; Weichselgartner 2002; v. Elverfeldt, Glade, and Dikau 2008).

In 2010 Egner and Pott similarly divided the concepts and perspectives of interdisciplinary risk research into five approaches. The natural-engineering sciences approach which is the equivalent to the formal-normative approach, the psychological approach, the social sciences approach, an economic approach which supplements Weichselgartners division and a geographical approach which is the equivalent to natural-spatial approach (Egner and Pott 2010).

In this master thesis the two main risk approaches, sociological-constructive and technical-objective will be presented in more depth in the following and a third risk approach, the geographical approach on hazard and risk, will additionally be presented to show the connection to the geographical nature of this master thesis.
3.1 Sociological-constructive approaches of risk

Since the modern age our lives and all events can no longer be only explained by higher power or the act of god (Keiler and Fuchs 2010). By acting in space and by making decisions we are choosing a certain amount of risk either on purpose or not on purpose and thereby influence our fate. This behaviour led to a breach in the modern industrial society turning into a modern risk society and even further into a global risk society (Beck 1986; Beck 2007). Whether on purpose or unintentionally we are exposed to several risks. As Renn said: "At any time, an individual, an organization or a society, as a whole, faces several options for taking action (including doing nothing), each of which is associated with potential positive or negative consequences" (Renn 2008c, p.1) As risks are based on the tension between "inevitable fate and individual responsibility" they cannot be influenced until you accept the future as been partially influenceable by the people (Renn et al. 2007, p.20). That means that "the future is in the hands of human beings and is not designed by some non-human agency" (Löfstedt and Boholm 2009, p.3).

All of the risks humans were passively exposed to in the past turned into internal controllable risks.

This all implies that there is a difference between threats and risks. Luhmann (1991) differs threats and risks in the degree of self-controllability. Everything external can be seen as a threat whereas every threat, which can be influenced, by the observer or someone else is seen as a risk. It additionally means that threats are the possibility of a negative or harmful event, no matter if it occurs or not. This idea of risk is based on a constructivist sociological approach coming from the social sciences. It basically means that risk is not something coming from outside respectively from 'nature' but it is something which is constructed and influenced by the perception and action of each person. Every individual person has a self-responsibility concerning the amount of risk they will face. The reason why people take this amount of risk is to achieve certain goals. No matter if they walk over the street to reach the other side of the street or they climb in the mountains to reach another peak. In recent years the sociological view on risks more and more dealt with the problems of natural hazards because there is an increasing number of natural hazards, which are affecting the areas where people settle. Due to political, economical, historical and social settings in these areas sever natural event do not longer turn out to be 'natural disasters' but social and cultural disaster where nature is only the trigger. The fact that natural hazards turn out not just to be calculable (see chapter 3.2) but also has sociological facets like risk awareness, risk perception or risk governance makes the idea of a combined risk approach more comprehensible (Dikau and Weichselgartner 2005).
Renn (2008a) goes even further and lists six different concepts in the sociological-constructive risk approach which he differentiates in two ways. On the one hand if the concept is affecting an individual or is it rather affecting the society and on the other hand if the concept’s epistemological level comes from a realistic-objective or a constructive level. The approaches are following:

- 1. Rational choice approach (realistic-individualistic) (Jaeger et al. 2001)
- 4. Critical theory (realistic-structuralistic) (Habermas 1981)
- 5. Theory of post-modernism (constructive-poststructuralistic) (Jaeger et al. 2001)

These different approaches show how complex and diverse sociologic-constructive approaches of risk are. There is no right or wrong but you have to find the approach which best suits your field of research.

### 3.2 Technical-objective approaches of risk

The second main approach of dealing with risks is a technical-scientific one, which mainly differs to the sociological approach in its risk assessment and its initial position. Contrary to the social constructive approaches the technical-scientific approaches include an objective assessment and the possibility to quantify risk (Müller-Mahn 2007). How objective the stated objectivity is has to be questioned and is not self-evident. Similar to the formal normative approach Weichselgartner (2002) mentioned the aim is to calculate the amount of risk people will face. This completely differs to the sociological approach due to its objectivity and quantification.

"Technical analysis provides society with a narrow definition on undesirable effects and confines possibilities to numerical probabilities based on relative frequencies. However, this narrowness is a virtue as much as it is a shortcoming" (Krimsky and Golding 1992, p.76). This statement shows that the technical approach is also very narrow in its view on risk. The way of assessing risk works differently compared to the way of assessing risk in a sociological context. First, side effects of an event or an action have to be defined. That gives the society the decision-making-power to what extent which damage will be dealt with. This decision will be taken due to the extent of urgency. After the possible damages are defined the next step will be to assess the
extent of damages and losses depending on the probability of occurrence (Renn et al. 2007). How this could work is shown in more detail in the following:

- Certain: >99 % chance of occurring in a given year (1 or more occurrences per year)
- Likely: 50-99 % chance of occurring in a given year (1 occurrence every 1-2 years)
- Possible: 5-49 % chance of occurring in a given year (1 occurrence every 2-20 years)
- Unlikely: 2-5 % chance of occurring in a given year (1 occurrence every 20-50 years)
- Rare: 1-2 % chance of occurring in a given year (1 occurrence every 50-100 years)
- Extremely rare: <1 % chance of occurring in a given year (1 occurrence every 100 or more years)

This classification is just one of many possibilities to describe the likelihood component of risk (Coppola 2015). The maximum extent of damages is not calculable from a mathematical point of view because an event E with n casualties could always be worse with an event E’ and n+1 casualties. To prevent a probability function to run towards infinity the analysis of the extent of damage will be limited at a reasonable possibility of occurrence like 1 x 10⁻⁹ or less (Renn et al. 2007). Event though the technical-scientific approaches mainly try to focus on natural environment they also include society concerns by the aspect of damages. These damages can only be defined in relation to people and society. For every geographical place in the world a specific amount of risk can be calculated by taking the chance of occurrence and the potential extent of damages. The aim is to make risks controllable and calculable by using suitable precautionary measures and by installing early warning systems (Müller-Mahn 2007). Although the attempt of calculating risk seems to be clear the parameters for the calculation are indistinct and discussable. The parameters for the possibility of occurrence and the amount of damages are also influenced by the society and social discourses and this limits the technical-objective approaches in their consideration due to their realistic-objective perspective (Egner and Pott 2010).

3.3 Geographical approaches on hazards and risk

The geographical approach on risk links to both, the technical-objective approaches and the sociological-constructive approaches. The geographic risk research deals with scientific perspectives on social and cultural issues and explicitly tries to overcome the dichotomy between objective and constructive approaches. If this overcoming does not develop the consequences for the society dealing with risks could be devastating. The solution for these problems will be a complement of both approaches. On the one hand dealing with the objective
threats in a spatial dimension and on the other hand taking the social constructions of risk into account (Müller-Mahn 2007). Only the presence and behaviour of mankind turn a natural phenomenon into a ‘natural disaster’. Therefore the environment people live in has to undergo a more precise assessment to limit the amount of damages by ‘natural disasters’ (Dikau 2008).

The geographical approach on risk has its origin in the geographical hazard research. Natural hazards take place in different geographical spaces and are caused by several geo factors. Burton and Kates (1964, p.417) defined natural hazards as "those elements in the physical environment, harmful to man and caused by forces extraneous to him" and White (1973, p.196) went even further and talked about "an interaction of people and nature governed by the co-existent state of adjustment of the human use system and the state of nature in the natural events system". These definitions point out the interaction between a physical event, which impacts human beings, and the environment they live in. If this conjunction is missing one we cannot talk about a hazard or disaster (Alexander 1993).

The task of geography is to interpret and deal with the causes and effects of different types of hazards. Hazard research in geography has a long tradition and deals with the interface of social and natural systems. This interdisciplinarity is also proven by different topics of geography which contribute to the hazards research like geomorphology, climate or soil from the physical geography as well as economics, society or development associated with the human geography and accounts to the interdisciplinary approach of risk and hazard research in geography (Dikau and Pohl 2007).

The birth of hazard research is stated back to Gilbert White in 1945 who analysed the effects and failures of flood prevention by the US government at the Mississippi delta. White and his two scholars Burton and Kates developed the human ecology and the environmental perception and behaviour approach with studies on risk perception and risk management concerning hazards (Pohl 2008). Burton, Kates and White (1978 p.19) also mention that "a basic distinction has to be made between extreme events in nature which are not necessarily hazardous to people, and the character of hazard events". Additional to this Kates (1976, p.134) stated five main questions of hazard research to reduce the effects of hazards to the people:

"(1) assess the extent of human occupancy in hazard zones;
(2) identify the full range of possible human adjustment to the hazard;
(3) study how men perceive and estimate the occurrence of the hazard;
(4) describe the process of adaption of damage-reducing adjustments in their social context; and
\( (5) \) estimate the optimal set of adjustments in terms of anticipated social consequences

Especially the terms of adjustment and adaption emerged to the central concepts of the geographical hazard research. Adjustment are target-oriented or incidentally developed (counter) measures emerging in a short time period. Examples are the right use of land, the construction of protection structures or the introduction of building regulations. Complementary to adjustments are adaptations to natural hazards. These are cultural or even biological mechanisms, which take much longer to develop and are controlling the dealing with natural hazards. They develop due to long-time experiences of societies with natural hazards. Examples are the construction of houses without cellars in flood prone areas or the planting of drought resistant plants (Pohl 2008).

Due to critical analysis of the human ecology approach, another important approach namely political ecology or the structural approach to natural hazards developed out of the geographical hazard research connected to several books like the *Interpretations of calamity - from the viewpoint of human ecology* by Hewitt (1983) or *Land degradation and Society* by Blaikie and Brookfield (1987). This new approach led to a greater focus on the social context and shows that natural hazards cannot be analysed without considering economic, social and political structures of the affected and vulnerable societies. The new idea of the political ecology was that "people's exposure to risk differs according to their class (which affects their income, how they live and where), whether they are male or female, what their ethnicity is, what age group they belong to, whether they are disabled or not, their immigration status, and so forth" (Wisner et al. 2004, p.6). Further the effects of 'natural disasters' get linked to underdevelopment of developing countries which are dependent on developed nations and therefore blames the global economy for the suffering of marginalised groups by geophysical events (Paul 2011). In the 1990s another paradigm evolved with the focus on the "mutuality of hazard and vulnerability to disaster due to complex interactions between nature and society" (Hilhorst 2004, p. 53). Both aspects are seen as mutual and the approach does not only try to focus on the vulnerability of societies but also tries to understand hazards as a product of human activities. Especially the social sciences with focus on climate change use this approach for elaborations (Hilhorst 2004).

As a conclusion it can be said that there are attempts to combine both perspectives of risk like the social-ecological concept (Renn et al. 2007) or the theory of the social amplification of risk (Kasperson et al. 1988). However, in the end Renn comes to the conclusion that "a fully integrated risk perception is not in sight" (Renn 2008b, p.203).
3.3.1 Vulnerability and resilience

Closely related to hazard research are the terms and concepts of vulnerability and resilience. These are concepts, which frame "our analysis of social-ecological change and the challenges of sustainability"(Miller et al. 2010, p.256). Vulnerability and resilience are often seen as the counterpart of each other. To better understand the concepts they will be shortly explained in the following.

The term vulnerability is defined by Wisner et al. (2004, p.11): "By vulnerability we mean the characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard (an extreme natural event or process)". This definition has developed from a natural hazard perspective. There are many other definitions of vulnerability. One possible source for further definitions is Thywissen (2006) who gives a broader view on the term vulnerability. The fact that vulnerability can be defined so differently shows the diverse perceptions of vulnerability connected to various approaches coming from a physical, social, economical or environmental background. There is however a clear distinction between risk and vulnerability as Alexander (2000, p.13) states: "Essentially, vulnerability refers to the potential for casualty, destruction, damage, disruption or other form of loss with respect to a particular element. Risk combines this with the probable size of impact to be expected from a known magnitude of hazard". Vulnerability is closely linked to risk and hazard research and became a crucial part of it. It also represents the connection between 'natural' and man-made topics. At this geographical research areas can be docked with interdisciplinary background. The importance of vulnerability will be also shown in this master thesis.

Since the UN's International Decade of natural disaster Reduction (IDNDR) they try to determine potential losses of lives and damages caused by natural hazards by using a vulnerability assessment (Cutter 2006). And "altering vulnerability is one effective risk-management strategy [...]" and with that statement it also shows the close relation between risk and vulnerability. One special kind of vulnerability is the environmental vulnerability that links perfectly to the topic of this master thesis. "Environmental vulnerability refers to the conditions of natural environment that either contribute to or reduce the suffering of disaster victims from impacts of extreme events" (Paul 2011, p.80). The environmental vulnerability develops from poor environmental practices causing environmental degradation like deforestation or overgrazing. This kind of vulnerability is decisive for the influence of environment on societies in post disaster situations resulting from a bad consideration of environment.
As already mentioned the term resilience is often mentioned as the counterpart of vulnerability and emerged out of psychology. The linkage of vulnerability and resilience is that by reducing vulnerability you achieve a greater resilience. The concept of resilience is essential and closely linked to disaster risk reduction at local, national and global levels (Paul 2011). A comprehensive definition of resilience is given by Tierney and Burneau (2007) quoting: "Resilience reflects a concern for improving the capacity of physical and human systems to respond to and recover from extreme events" (K. Tierney and Bruneau 2007, p.14). Just like vulnerability the idea of resilience plays a big role in the recovery of societies after damages caused by natural hazards. The recurrence of natural hazards and the recovery from them should be seen as a learning process whereby the resilience should increase and the vulnerability should decrease. Rounding off a figure by Thywissen (2006) is presented to show elements influencing risk (see figure 1). The figure shows risk as the umbrella term where the mathematical relationships between the four risk elements are unknown.

![Figure 1: Components of risk (adapted from Thywissen 2006, p.39)](image)

### 3.4 Risk governance

The term 'governance' developed in the 1980’s linked to development research and has experienced enormous attention in the last 15 years in several research fields like sociology of environment, political sciences, policy studies as well as risk research. Governance on a national scale can be described as the "structures and processes for collective decision-making involving governmental and non-governmental actors" (Nye and Donahue 2000, p.12). On a global scale "governance embodies a horizontally organized structure of functional self-regulation..."
encompassing state and non-state actors bringing about collectively binding decisions without superior authority” (Wolf 2002, p.36).

Risk governance looks at the complex network of actors, conventions, rules, mechanisms and processes related to the relevance of the collection, analysis and communication of risk information. "Encompassing the combined risk-relevant decisions and actions of both governmental and private actors, risk governance is of particular importance in, but not restricted to, situations where there is no single authority to take a binding risk management decision, but where, instead, the nature of risk requires the collaboration of, and coordination between a range of different stakeholders” (Renn 2008c, p.9). According to Amman (2006, p.6) a "good risk governance stands for transparency in decision-making, effectiveness and efficiency of the measures, accountability, strategic focus, sustainability, equity and fairness, respect for the law and the need for the solution to be politically and legally realizable as well as ethically and publicly acceptable". Risk governance includes risk analysis with its three established elements risk assessment, risk communication and risk management. On the basis of that the IRGC developed a risk governance framework, which you can see in a simplified version in figure 2.

Due to the increasing numbers of disasters causing harm to people a multifaceted and international approach to deal with these risks was developed on the base of the governance idea having one of its roots in the 'TRUSTNET-concerted action on risk governance'. This was a programme with a wide range of disciplines financed by the European Commission. This notion of risk governance was picked up by the International Risk Governance Council (IRGC), founded in 2003 on behalf of the Swiss government, and turned it into a concept (van Asselt and Renn 2011). It is an independent, private and a non-profit organisation. The IRGC states that risk governance is "the actions, processes, traditions and institutions by which authority is exercised and decisions are taken and implemented". Carrying on they say that "risk governance applies the principles of good governance to the identification, assessment, management and communication of risks" (IRGC 2016). The mission of the IRGC is "to support governments, industry, NGOs and other organisations in their efforts to deal with major and global risks facing society and to foster public confidence in risk governance" (IRGC 2005, p.5).
The risk governance framework tries to include all significant aspects for an effective and sensible handling with risk regarding the concerns of society. The four phases of the risk governance framework help to work out the two main challenges of risk governance. One challenge is to generate and collect knowledge about the risk and the other challenge is how to control and mitigate or otherwise handle the risk.

The first phase of pre-assessment conduces to set the framework of how to work with the risk. It tries to restrict the risk by 'framing' it and with that trying to define the problem and how it could be handled. This happens with the help of early warning systems and monitoring to detect and identify unusual phenomena or events. "Pre-assessment clarifies the various perspectives on a risk, defines the issue to be looked at and forms the baseline for how a risk is assessed and managed" (IRGC 2007, p. 6).

The second phase is the risk appraisal. This phase contribute to set a knowledge base on whether a risk should be taken and how it can possibly be controlled and reduced. Risk appraisal includes "scientific risk assessment – a conventional assessment of the risk's factual, physical and measurable characteristics including the probability of it happening – and a concern assessment – a systematic analysis of the associations and perceived consequences (benefits and
risks) that stakeholders, individuals, groups or different cultures may associate with a hazard or cause of hazard" (IRGC 2007, p.7). The concern assessment was introduced to take all the emotions of the people and their different view on risk into account.

The third phase is the characterisation and evaluation. This phase was deliberately included by the IRGC to consider both sides, the scientifically evidential side which gives scientific facts of the risk and combined with that the understanding of societal values to make noncontroversial judgements whether a risk is acceptable, tolerable or intolerable. In the end of the characterisation and evaluation phase there should be a judgement of the acceptability and tolerability of risks.

The fourth and last phase is risk management. "Risk management involves the design and implementation of the actions and remedies required to avoid, reduce, transfer or retain the risks" (IRGC 2007, p.9). The aim of the risk management is to assess, generate, evaluate and select appropriate risk reduction possibilities and to develop measures to avoid a intolerable risk or rather reduce the risk to the point of acceptance (e.g. IRGC 2007; Renn 2008c; Renn and Dreyer 2010). In 2013 the dimension of space was added to the risk governance model and therefore made it more applicable by creating a fair and effective institutional arrangement. This happens by including the involvement of public and stakeholders while they try to cope with the challenges raised by the three attributes of risk knowledge (complexity, scientific uncertainty, socio-political ambiguity) (Renn and Klinke 2013). In the following the three elements of risk management and risk communication and risk perception will be analysed in more depth as they are closely connected to the PDNA process.

3.5 Risk management

Risk management refers to both risk mitigation and risk preparedness. Risk mitigation are actions to reduce the threats to property, environment and life caused by extreme events and risk preparedness is to ensure that individuals and communities are forecasting, taking precautionary measures and are responding to an impending disaster (Christoplos, Mitchell, and Liljel 2001).

Essentially risk management tries to achieve a minimisation, distribution or sharing of possible negative consequences caused by ‘natural disasters’. This only works if relevant private or public entities use resources for risk reduction. This will lead to a reduction of the occurrence of high magnitude disasters and of the negative effects caused by these extreme events. "These
measures are undertaken to make individuals, households, and communities or society as a whole more resilient to disasters. The main purpose of risk management is to reduce all impacts of 'natural disasters' by implementing and integrating all risk reduction measures" (Paul 2011, p.105f.). According to Tobin and Montz (1997) there are few essential processes in risk management. The first process is the identification of exposure by collecting data about all areas, people or property that can possibly be damaged by a 'natural disaster’. The exposure can either be physical, referring to identify areas that are at risk, or financial, where the aim is to reduce all types of losses caused by the disaster.

The second process is to identify available options for the reduction of potential losses linked to a particular hazard. These so called adjustments are the main goal for a risk reduction in risk management. The adjustments are often grouped as

(a) adjustments affecting the cause,
(b) adjustments that are modifying the hazard,
(c) adjustments that are modifying loss potential and
(d) adjustments to losses by planning for losses, spreading the losses and bearing the losses (Burton, Kates, and White 1993).

The options for the reduction of damages and losses are hazard specific and are not always available at a given time at a given place (Tobin and Montz 1997).

One way to reduce losses is to influence the causes of a 'natural disaster'. This can happen by changing the land use and the watershed treatment before a flood event. On a global scale this can happen by reducing the greenhouse gases emission that will affect global warming and with that will affect more frequent and severe hazards. There are however hazards like earthquakes where there is no way of altering the causes. To reduce exposure the physical processes of hazards has to be modified. "The aim here is to reduce the damage potential associated with a particular hazard by some degree of physical control over the processes involved. This strategy may also be termed "environmental control". It is based on the premise that prevention is better than cure and can be accomplished through both large-and small-scale environmental control" (Paul 2011, p.107).

The last two processes of risk management are to analyse how efficient possible options for reducing hazard losses are and then to choose and implement the best options on a particular hazard in an area. As you can see the process of risk management is very diverse being influenced by social, political, economic, technical and perceptual factors (Power 2007). The decision to do nothing about hazard losses is not seen as risk management. It is essential to "ensure unity of effort and collaboration among all levels of government and all elements of a community. They need to value knowledge-based approaches, based on education, training, experience, ethical practice, public stewardship, and continuous improvement" (Paul 2011, p.108).
3.6 Risk communication

Risk communication is another factor, which has a big influence on risk when dealing with natural hazards. The core of a successful assessment and management of risk is an effective communication (Paul, 2011). The reason for the importance of risk communication is the lack of proper identification of risks connected to natural hazards by the people. People are often not able or aware of using appropriate mitigation measures due to the shortage of important and accurate information for approaching and potential risks as well as the awareness of the available options when they are confronting such dangers. "Therefore there is a need for disseminating scientific information in an easy-to-understand format which will help them take appropriate action to reduce risks from natural hazards. Risk communication seeks to supply people at risk with the information they need to make informed, independent judgements about risks associated with extreme events" (Paul 2011, p.108). According to Paul (2011) experts and the media are the two main sources for lay people to get information and knowledge about risks. Risk managers, risk analysts and risk message preparers are some other sources for the people. Nevertheless to achieve a good and broad information flow to the people the government’s influence is increasingly high. With trainings on risk behaviour and town meetings about possible risks the people are facing the powerfulness of risks communication could increase and the risks awareness can additionally rise (Renn 2008c; Paul 2011).

There are three phases of evolution of risk communication practices. The first phase focused on the need of conveyance of probabilistic thinking to the people and the acceptance of the lay people concerning risk management practices by institutions. After this failed the second phase concentrated on persuasion of the people with a focus on public relations and to convince the people of their unacceptable behaviour. This was linked to a campaign on unhealthiness of smoking (Leiss 1996). The third and "current phase of risk communication stresses a two-way communication process in which it is not only the members of the public who are expected to engage in a social learning process, but the risk managers as well. The objective of this communication effort is to build up mutual trust by responding to the concerns of the public and relevant stakeholders" (Renn 2008c, p.202).

The process of risk communication is interactive and exchanges opinions and information among several actors like individuals, groups and risk managers. The discussion about risks and the methods how to manage them are also involved in risk communication and lead at best to an improved individual and collective decision making as well as an increase of the coordination between various levels of government or a better educated public. "Risk communication should consider the multi- stage process people use in deciding how to prepare for and respond to a crisis"
(Burns and Slovic 2012, p. 582). If risk communication is successful the risk reduction behaviour of the people concerning hazards can change at an individual and community level. To choose the right and appropriate action to mitigate risks is still such a complex process that risk communication alone is not powerful enough to change for the better.

The task to mitigate risk is a gear with several gear wheels that have to work together to record progress. If one gear wheel improves the others will sometimes also improve but if there is one bad gear wheel the whole system can start to stutter. To mitigate risks many gear wheels has to be grabbed at the same time to have the right understanding of risks and decision making at all levels affected (government, society, group, individual). Only by doing so an affective dealing with risks is guaranteed.

3.7 Risk perception

Another factor, which is essentially influencing the dealing with risks, is risk perception. Commonly the term risk perception is used in combination with natural hazards. It is the subjective judgement of each individual about the severity and characteristics of a specific risk (Slovic 1992). This perception and avoidance of harmful condition is necessary for all living organisms to survive and the ability to learn from past experiences also contributes to it. "Humans have an additional capability that allows them to alter their environment as well as respond to it. This capacity both creates and reduces risk" (Slovic 2000, 220). Hewitt (1997) also points out how important risk perception is in the whole process of managing risks. It is an essential and valid component of risk management next to scientific assessments.

Risk perception of individuals and groups is significant in producing an effective plan for risk communication. In addition risk perception is crucial to develop emergency preparedness measures, which are effective and accepted by the public. These measures happen at household, community, regional and national level (Hewitt 1983; 1997). Risk perception is decisive to understand the choices and adjustments people make before, after and during a hazard event. Especially disaster policies at all governmental levels are designed with the consideration of risk perception. This is because the public involvement in hazard planning has a growing importance and that shows that the interest of the citizens is taken into account (Brody, Godschalk, and Burby 2003). Most of risk perception can be lead back to experiences of the people but risk perception can also happen at a governmental level.
With the help of governments, NGOs or other institutions the behavioural experiences regarding 'natural disasters' can be shared and that could lead to a change of consciousness. If a government changes its perception on risk, it could alter the behaviour in a hazard situation and therefore change the risk management. This change in governmental risk perception can be expressed in different actions to train and educate the population about possible risks. "Research indicates that people become more aware of floods and are more motivated to initiate protective action if they are involved in a participatory exercise. This seems mainly due to both a shift toward more trust in the authorities and the experts and a shift toward realizing personal agency to protect oneself" (Wachinger et al. 2013, p.1061). These actions can be town meetings, training for early warning systems or giving out educational material. That means if the agencies specify their risk perception and transfer this to the population and the population trusts the agencies there could be an improvement in risk management. Regarding 'natural disasters' "there is a clear need to provide researchers and practitioners with a better understanding of how individuals, communities, and even nations should prepare for and respond to such calamities" (Burns and Slovic 2012, p.579).

### 3.8 Models and frameworks of risk and latest discussions in hazard risk research

The link between geography and risk was already mentioned briefly in chapter 3.3. The way risks are treated developed from ancient myths and the punishment of god to scientific calculations and social behaviours (Keiler and Fuchs 2010). There are several models and frameworks which work with risks and threats and which developed from different scientific perspectives. Next to the hazard research with its origin in the studies of Gilbert White and flood protection at the Mississippi many other ideas and approaches developed (White 1964). One of them is the hazard-of-place model of vulnerability designed by Susan Cutter, who tried to combine traditional vulnerability with more recent thoughts on social vulnerability (Cutter 1996). Also during the 1990’s the sustainable livelihood framework developed with the attention moving away from pure calculation of numbers to the social changes and behaviours caused by natural hazards and threats. This framework is still very popular today to identify changes of the peoples livelihoods based on five capitals in relation to 'natural disasters'. The framework was pursued by the Department for International Development (DFID) concentrating on social grievances in developing countries (Carney, Great Britain, and Department for International Development 2003).
Another popular model is the Pressure and Release model by Wisner et al. (2004) published at the beginning of the new millennium. They say that it is "based on the idea that an explanation of disasters requires us to trace the connections that link the impact of a hazard on people with a series of social factors and processes that generate vulnerability" (Wisner et al. 2004, p.52). These frameworks and models show the broad range of studies on risk and its included research fields.

Talking about the hazard risk research a known representative from Germany is Hans-Georg Bohle who established aspects of development geography into the field of risk research. With his studies on famine, poverty and water crisis in South Asian countries he also contributed to livelihood research on a global scale. Bohle developed, in cooperation with Watts, a concept of causal structure of vulnerability (Watts and Bohle 1993). Next to Bohle the German geographer Robert Geipel has a main influence in geographic risk research with his studies on an earthquake in Friaul in 1976. He is also know from the 'Münchner Schule der Sozialgeographie' (Munich school for social geography) with his influence in vulnerabilities to hazard risk (Pohl 2008).

Geographic risk research today is mainly influenced by the Man-Environment paradigm tradition in Geography. Especially in risk and hazard research the combination and interaction of human and nature turned out to be crucial. This shows the interface research and is the basis for the third pillar in Geography (Stötter and Coy, 2008). The interaction between human and nature was always based on the fact that mankind is the smaller and weaker part. The inequality was then tried to level by mankind using technical measures influencing nature. Later these technical solutions were critically questioned due to the retroactive effects of nature caused by interventions, the facts that solutions for the reduction of natural hazards are coming from externals and that the use of technical solutions is limited. Burton et al. (1993) even added a chapter to their 1978 studies in 1993 showing the change of hazard research. The traditional focus on the suddenly appearing hazard gets less attention and two other areas of observation receive higher attention now. On the one hand vulnerable societal structures, the people's and society's vulnerabilities and other precarious conditions and on the other hand the overall ecological context receive more attention now.

Hazard risk research now tries to analyse and investigate the creation and making of 'natural' hazards (Pohl 2008). This paradigm shift also includes the discussion about how natural are 'natural disasters'. With books from Felgentreff and Glade (2008) "Naturrisken und Sozialkatastrophen" and Wisner et al. (2004) "At Risk" the discussion focused on how far 'natural disasters' are man made disasters. Main ideas of this discussion are thoughts on the construction of disasters, how far man is influencing and intervening nature and on the distinction and separability of natural and social disasters (Wisner et al. 2004; Felgentreff and
Another important paper in this context is Wisner's "Regions at risk or people at risk" where he discussed about the 'naturalness' of 'natural disasters' (Wisner 2007).

Current research concerning risk is focusing on risk communication, risk perception, regulatory issues and policy and the linkage between climate change and risk. Risk communication discourses work on the power of media (Hove et al. 2015), the influence of media in crisis situations (Regan et al. 2016) and how risk communication could be improved (Claassen, Bostrom, and Timmermans 2016). Risk perception is recently connected to climate change and the perception of agricultural risks (Menapace, Colson, and Raffaelli 2015), additionally risk perception of organisations was investigated with an example on nuclear power (Wong 2015) and individual risk perception was combined in an integrated approach with the implementation of farmer's risk management strategies (van Winsen et al. 2016). Policy changes with an example on environmental risk assessments (Hunka et al. 2015) and policy framing and responses in connection to climate change (Hurlbert and Gupta 2016) are latest studies in the topic of regulatory issues and policy. One of the seminal and most influential topics is the linkage of risk and climate change. Studies like the assessment of future flood risk in Europe under a high level of global warming (Alfieri et al. 2015), the connection of sea level rise and flood risk management with strategic planning processes (Kuklicke and Demeritt 2016) and the analysis on risk management associated with climate change (Baard 2016) are just few examples of studies working on risk and climate change.

To complement the view on risk and disasters the emergence of some renowned journals should be mentioned at this place like Natural Hazards (since 1989), Disaster Prevention and Management (since 1992), Journal of Risk Research (since 1998) or Environmental Hazards (since 1999).
4. Global help and disaster management

The following chapter will give an idea why global help and risk reduction is needed. Further the history and development of risk reduction will be presented followed by the disaster management cycle. The phases of the cycle will be analysed and related to this master thesis. After that international disaster management will be introduced with a closer look at PDNAs.

4.1 Need for global Help

The need for global help after 'natural disasters' had increased in the last decades. National and international agencies, NGO's, INGO's and governments are helping mainly developing countries in the case of an emergency. The necessity for more global help derives among others from ongoing climate change, unsuitable land use and growing populations settling in hazard prone areas, which causes more and more severe impacts of 'natural disasters'. According to the IPCC (Intergovernmental Panel on Climate Change) climate change can no longer be denied and "recent climate changes have had widespread impacts on human and natural systems" (IPCC 2014, p.2). The changes on natural system are one reason for a more frequent occurrence of natural hazards in the last decades. Coming along the severity of the natural hazards tend to be higher in recent years which shows how factors like the climate change causes actions to be taken by the global community (Hoppe and Loster 2007).

Munich Re, the biggest reinsurance company in the world, statistically records the amount of natural hazards since 1950. Their statistics clearly show the increase in major natural events over the last 60 years shown in figure 3. With a look at the trend line you can see a clear increase of major natural events from 1950 to 2008. Even though this chart clearly shows an increase it has to be questioned due to criteria to call it a major natural event. The amount of major natural events is always connected to the impact of the event.

The barrier of money plays an important role because a severe disaster in a developing country can cause few damages shown in US Dollar but can cause many thousand deaths. The fact that there is an increase in 'natural disasters' worldwide is shown in figure 4. You can see up to double as many 'natural disasters' worldwide compared to 35 years ago (Munich Re 2010; Munich Re 2016). This increasing occurrence still leads to a more frequent need for disaster relief and assistance. Especially developing countries can hardly cope with the physical and social impacts of a major 'natural disaster' and that leads to a growth of global recovery help.
The United Nations Development Programme (UNDP) realised the importance to alter the causes of climate change. For example UNDP released a document in 2011 called "Adapting to climate change" which should help developing countries to reduce the CO2 emission and alter the effects of climate change (UNDP 2011).

With a look on impending natural hazards it has to be said that there are two main problems which the global community faces. On the one hand, as just mentioned, climate change and other factors like population growth and misuse of land intensify the number and the severity of future 'natural disasters'. Apart from geophysical events, which are not influenced by climate change all hydrological, meteorological and climate events are increasing in numbers. The global community will have to support other countries more often in the case of a 'natural disaster'. At this point the importance of mitigation should be mentioned because if the occurrence of natural hazards cannot be reduced at least the impact on the people can be minimised. Globally the greater amount of upcoming natural hazards leads to an increasing disparity worldwide. Natural hazards can cause an even harder drift between rich and poor people in the world. It tends to be the poor who are affected most by 'natural disasters' even though developing and industrialised countries are affected at about the same rate. Rich countries suffer fewer deaths, have a smaller
extent of affected people and also have the capability and capacity to cope with the impacts of a ‘natural disaster’ (IPCC 2014). The after-effects of a disaster like water shortage, diseases, coastal flooding or hunger, often harder affect poor people. The link between climate change and food insecurity was already present over 20 years ago (Bohle, Downing, and Watts 1994). 15 years later Ruth and Ibarrarán went further and backed up this problem by saying that "economic, social and environmental impacts, in turn, further increase vulnerability to ‘natural disasters’ and tend to set back development, destroy livelihoods (especially of the poor), and increase disparity both nationally and worldwide" (Ruth and Ibarrarán 2009, p.3). Reasons for the poor to be most affected are the population growth, unsustainable economic growth and the people’s life circumstances. Next to the quality of buildings it is the area where they settle. Due to a lack of choices and a different risk perception they often do not see the risk to settle at e.g. floodplains, coastal areas or next to steep slopes. They rather see the useful benefit of it (water supply, food source) then the probability of being affected by a ‘natural disaster’ and therefore accept the risk (Ibarrarán and Ruth 2009). The global community should try to work on this basic problem next to improve the mechanisms and implementations of global help.
4.2 The history and development of disaster response

Before presenting global help in more detail with a particularly look at PDNAs the history and development of global emergency and response actions with a focus on disaster risk reduction will be shown.

Strategies of risk management can be traced back thousands of years ago. Around 3200 BC in Iraq community members could appeal to the Asipu (a godlike figure) to get advice about difficult situations involved with danger and risk (Covello and Mumpower 1985). Another example is the historical emergency response after an eruption of the Vesuvius during Roman times. Evidence suggests that the people evacuated from Pompeii by the demand of the city's leader and therefore the majority survived. An example for ancient risk mitigation was done by Amenemhet III (1817-1722 BC) in Egypt who diverted floodwater of the river Nile with the help of 200 water wheels to prevent the agricultural areas from being flooded (Quarantelli 2000).

Even though there is no explicit pattern how countries developed their disaster management actions there is a clear period of time when cities started to developed centralised safeguarding, the time of civil defence. During the twentieth century activities emerged for addressing response, mitigation and preparedness to a broad range of disasters. Emphasis was on the threats by air raids during the Second World War and afterwards the ongoing danger of a nuclear attack. Mechanism of modern emergency management was already involved at that time like early warning alarms, detection mechanisms, strengthened shelter and rescue teams. Although many countries put these systems in legislation only few civil defence units developed into a more extensive disaster management organisation (Quarantelli 2000).

The need for national emergency management to take a key role emerged in the 1970s and 1980s. Out of the necessity to counteract obvious disaster risk many countries developed their disaster management resources. Others, especially in South America e.g. Peru, Nicaragua or Guatemala, established their disaster management structures after being criticised for a deficient ‘natural disaster’ management (Coppola 2015). The focus on ‘natural disaster’ risk reduction finally aroused with the United Nations General Assembly declaring the 1990s to be the "International Decade for natural disaster Reduction" (IDNDR) as already mentioned in chapter 3.3.1 and later in chapter 4.3.3. Especially the international coordination for a reduction of material, social and economic losses caused by ‘natural disasters’, with a focus on developing countries, was the goal for this initiative. The General Assembly formulated goals like e.g. an improvement in mitigation capacity, a development of guidelines and strategies for applying existing technical and scientific knowledge or the development of "measures for the assessment, prediction, prevention and mitigation of ‘natural disasters’ through programmes of technical
assistance, [...]” (United Nations 1989). To make all that work the UN expected governments participating to take actions at national level. These actions included e.g. formulating national disaster management programmes with policies on economy, land use and insurance for disaster prevention, taking measures to increase the public awareness to possible damages and demonstrate the importance of risk preparedness, reducing the vulnerability of health care centres and hospitals and keeping the General Secretary informed about plans and actions.

In 1994 the UN member states met in Yokohama, Japan, at the World Conference on natural disaster Reduction and developed the Yokohama Strategy and Plan of Action for a Safer World to assess the progress of the IDNDR. The UN was affirmed through this document to intensify actions concerning disaster protection and to concentrate on the reduction of society's vulnerability on a global scale. To reinforce these plans all participating nations accepted ten principles to be applied to their nations disaster management (ISDR 1994).

After the IDNDR finished the UN General Assembly decided to continue their effort by starting the International Strategy for Disaster Reduction (ISDR) in December 1999. The main vision of the ISDR was "to enable all societies to become resilient to natural hazards and related technological and environmental disasters, in order to reduce environmental, human, economic and social losses" (UNISDR 2001). Four main objectives were announced for the ISDR including the awareness about risk and vulnerability to ‘natural disaster’ and disaster reduction, obtaining commitments from authorities to reduce the risk posed to people’s livelihoods and their environment as well as economic and social infrastructures, to encourage intersectoral and interdisciplinary partnerships and expand risk reduction networks, and to improve scientific knowledge about the causes and effects of ‘natural disasters’ and with that promote disaster reduction (UNISDR 2001).

The ongoing global process of disaster risk reduction was refined in 2005 with the World Conference on Disaster Risk Reduction in Kobe, Japan. 168 attending countries adopted the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters (HFA). The idea of the HFA was to intensify the global community's look on a more comprehensive and holistic approach to disaster risk reduction. Three strategic goals were ratified to be pursued during the decade. First was to integrate disaster risk reduction into policies and planning concerning sustainable development, second the institutions, mechanisms and capacities to built resilience to natural hazards should be developed and strengthened and third risk reduction approaches should systematically be a factor in the implementation of emergency response, recovery and preparedness programmes.
The latest framework on disaster risk reduction is the Sendai Framework on Disaster Risk Reduction 2015-2030 developed at the Third World Conference on Risk Reduction in Sendai, Japan, 2015. After the basis of risk reduction was established in the 1990s, over 25 years later, there are four prioritised actions now, worked out at the Sendai Conference. The first action is to better understand disaster risk, the second action is to strengthen disaster risk governance and with that to help managing disaster risk. The third action is a higher investment in disaster risk reduction to increase resilience and the last action is a rise of disaster preparedness for better response and then to "build back better" in recovery, reconstruction and rehabilitation. These actions should help to fulfil the goals elaborated like e.g. reduction of global disaster mortality, reduction of disaster economic losses, increase the number of countries with local and national disaster risk reduction strategies and a significant increase of the accessibility to multi-hazard early warning systems (UNISDR 2015).

4.3 The Disaster Management Cycle

In the context of disaster management the disaster management cycle will be presented to get an idea of ideal disaster management. The disaster management cycle is a modern idea of disaster management and should represent all influences and actions happened since the IDNDR. It shows the temporal phases of emergency management and brings them into a logical order. These phases "illustrate the ongoing process by which disaster management agencies - with active support from governments, businesses, and other entities - plan to reduce losses from hazards, assure prompt assistance to disaster victims, and take steps to recover from the impacts of disasters as quickly as possible. Appropriate actions and measures at all stages in the cycle lead to greater preparedness, better warnings, as well as reduction in individual and community vulnerability to hazards and disasters" (Paul 2011, p.157).

When looking at the impact/hazard as the starting point of the disaster management cycle the proceeding phases are response, recovery, mitigation and preparation/preparedness (see figure 5) which will be presented in the following sub-chapters. There is however no right starting point, so for each purpose the starting point has to be chosen (Wood, Boruff, and Smith 2013). As these phases are not clearly separable from each other there will be overlapping however they have helped to guarantee a comprehensive disaster management by organising planning, activities, policy and research (Mileti 1999). Just like the problem with every model the reality differs. In the case of the disaster management cycle not only the isolated occurrence of the phases but also the precise order can differ. Additionally the overlapping of the phases and the length of each phase highly depends on the type of disaster and its severity linked to the
available resources to cope with the disaster (Paul, 2011). With the focus on PDNAs the response and recovery phase will be explained because the phases after the impact/disaster are the one dealt with in PDNAs. The mitigation phase will then be presented in more detail because risk mitigation respectively disaster mitigation is the goal for every PDNA. The fact that the disaster management cycle is constructed for disasters to happen again the phases of mitigation and preparation are also of high interest concerning PDNAs because these phases should lead to an increase of resilience and a decrease of vulnerability.

![Disaster Management Cycle](image)

**Figure 5:** The disaster management cycle (adapted from Wood, Boruff and Smith 2013, p.150)

### 4.3.1 Disaster Response

When we are talking about response we mean all actions to save lives, to minimise property damages and to improve the effectiveness of recovery after a disaster. These actions can all take place immediately before or during or after the disaster from one day up to few weeks (Mileti 1999). There are several actions happening during the response phase like the search for and the rescue of survivors, the emergency care for injured people, the proper disposal of dead bodies, providing emergency shelter, water and food, repairing key infrastructure, protecting the peoples properties and trying to avoid secondary hazards like fire. These actions can take place at household, community, national and international level (Mitchell and Cutter 1997).
Another function happening during the response phase is the execution of a disaster assessment later explained in more detail in chapter 4.4.2.

The duration of emergency response as an immediate aftermath of a disaster can last from several hours to days or even weeks after the 'natural disaster' (Fothergill and Peek 2004). When looking at the disaster recovery cycle the disaster response happens just at the early relief phase (see figure 6). The disaster response phase is so crucial because a poor or inadequate response leads to an intensification of the plight and has an even harder effect on the people who are already suffering. "Such response also reflects a failure of government agencies and public administrators to provide adequate emergency support to disaster victims of a major event" (Paul 2011, p.198). Even though these failures are often associated with developing countries it must not always be the case e.g. when looking at the United States and Hurricane Katrina the poor response is seen as an administrative failure (Eikenberry, Arroyave, and Cooper 2007). Next to a poor or inadequate response a delayed response should be prevented. The first 72 hours after a disaster are seen as the most significant ones by disaster experts. During this time most lives can be saved by a prompt mobilisation of emergency resources (Coppola, 2015).

4.3.2 Disaster Recovery

Just after and overlapping with the response phase the disaster recovery phase takes place. The main purpose of the recovery phase is to compensate the damages caused by the disaster and to get the survivors back to "normality". In literature about disasters the term recovery is mostly used as a synonym for reconstruction, restoration, rehabilitation, rebuilding and post disaster redevelopment (Quarantelli 1998). During the recovery process different groups like survivors from the disaster, communities and organisations have to move through several stages and steps that take place in varying rates.

The process of recovery can be seen as an interaction and cooperation of actors making decisions. This could include businesses, households or the whole community (Mileti 1999). "In relation to other functions, recovery is by far the most costly and more funding is dedicated to it than to any other disaster management cycle. The range of individuals, organizations, institutions, and groups involved in disaster recovery is also greater than in any of the other phases of disaster management cycle" (Paul 2011, p.218). The greatest responsibility and influence on the recovery phase is however still with the local government. The efforts by the government can lead to best results due to their knowledge about the local circumstances and the interconnectedness with the population.
The time a country needs to recover from a disaster and that the local government needs to implement all recovery actions can vary from weeks to months and up to years (Tierney, Lindell, and Perry 2001). In figure 6 the ideal process of recovery is visualised. The cycle of relief and development start right after a disaster but while development encompasses the whole recovery relief takes places for only around six months up to a year. Especially information about entitlements and opportunities concerning the people’s livelihoods are essential for the relief cycle. The rehabilitation cycle, which follows up and overlaps the relief cycle, happens usually between 12 and 20 months. And the last part, the reconstruction cycle, takes place one to four years after the disaster (Middleton and O’Keefe 1998). The biggest amount of money is needed during the relief cycle followed by rehabilitation and reconstruction. After 60 month the whole recovery process should be finished and "normality" should have returned to the people. Although the model is based on the experiences of several disasters it will vary in its shape of curves and duration of each cycle. Further it will differ due to the type of disaster, country of occurrence and area where the disaster happened.

Out of Frerks (1995) model on the ideal disaster recovery cycle and a modified model by Kirkby et al. (1997) the models seen in figure 7 developed. These models show the difference between the recovery cycle in a developing country and an industrialized country. There are several differences to the ideal disaster recovery model and also differences among them (Alexander 2000). First of all the time scale differs. In developing countries the duration of the recovery
takes about 60 months whereas in industrialised countries it can take up to ten years due to the resources and the disaster management structures. Secondly the duration of each cycle differs plus the costs connected with it. This is also seen when looking at the cumulative disbursement curves. The most striking differences in the two models are on the one hand the reconstruction phase and on the other hand the distribution phase. While the relief, rehabilitation and reconstruction phases start and happen at the same time and vary in their duration in developing countries there is a clear chronology with short overlaps in industrialised countries. The other difference is the cost distribution. While the relief phase needs most money in developing countries the reconstruction phase needs most money in industrialised countries. In the case of this master thesis especially the model of the developing countries is of main interest because most of the PDNAs take place in developing countries.

Figure 7: Stages in recovery from disasters: (a) for a developing country, (b) for an industrialised nation (Alexander 200, p.4)
4.3.3 Disaster Mitigation

Disaster mitigation is probably one of the most important aspects of disaster management. If the risk mitigation increases the people will suffer less from a recurring disaster and this should be the mid- and long-term goal of disaster management and tools like PDNA. On the basis of that the United Nations announced the 1990s the International Decade for natural disaster Reduction (IDNDR) after devastating ‘natural disasters’ in the 1970s and 1980s. This should bring back the focus and emphasis on mitigation and not only on disaster relief and humanitarian aid (Haque and Burton 2005). With the use of new technologies and spreading of scientific knowledge the UN tried to reduce the loss of life, the damage of property and the disruption in social and economic aspects due to ‘natural disasters’.

Since the 2000s the idea of the IDNDR is pursued in the International Strategy for Disaster Reduction (ISDR) (UNISDR 2016). This strategy does not only help the affected people in short-term manners but also concentrates and focuses on mid- and long-term issues. "The IDNDR recognized mitigation as an essential component of disaster risk reduction efforts for all countries of the world. [...] more attention was devoted to mitigation strategies. Thus disaster mitigation means risk (expected loss) mitigation" (Paul 2011, p.159). Mitigation has several aspects that can differ in time and space and depend on the type of ‘natural disaster’. According to Maskrey "mitigation refers to measures which can be taken to minimise the destructive and disruptive effects of hazards and thus lessen the magnitude of a disaster. Mitigation measures can be of different kinds, ranging from physical measures such as flood defences or safe building design to legislation, training and public awareness. Mitigation is an activity which can take place at any time: before a disaster occurs, during an emergency, or after disaster, during recovery or reconstruction" (Maskrey 1989, p.39).

Mitigation is also often linked to policies and activities done by the government to reduce the vulnerability of the people and the damage from future ‘natural disasters’. The time after a disaster is often seen as an opportunity for the local government because many people then see the necessity for mitigation measures. The public opinion gets sensitised and therefore political decisions get facilitated with demands on public safety in the future (Alexander 2000). Concerning disaster mitigation there are five important different goals: risk likelihood reduction, risk consequence reduction, risk avoidance, risk acceptance and risk transfer, sharing or spreading (Coppola 2015).

Risk likelihood reduction tries to reduce the occurrence of some hazards. Especially the occurrence of floods can be reduced by building floodwalls, levees, dikes or dams. These
measures secure the people up to a certain degree depending on the design of the construction. Nonetheless there are many hazards where the risk likelihood cannot yet be reduced like hurricanes or earthquakes. Measures to mitigate risk likelihood can either be of structural or a non-structural. Structural measures can be dams or dikes as mentioned before and non-structural measures could be legislation and regulations by the government or the change in land use to get back retention area (Paul 2011).

Risk consequence reduction picks up the idea that some disasters are unavoidable and therefore the consequences tried to be reduced. These could be public cyclone shelter or safe rooms in hurricane affected areas. People can protect themselves during the disaster by going there. Such rooms can be installed in people's basements and thick concrete walls and reinforced ceiling will give maximum protection. This public shelter is strongly demanded in the United States but also in developing countries like Bangladesh multi-storied buildings have been built to shelter up to 1500-2000 people during a cyclone. Next to shelter buildings also embankments at the coast can protect the people from storm surges during cyclones. But not only construction measures but also support of the environment can be seen as a measure. In Bangladesh large areas were afforested to protect people living on the coast and to support the coastal environment against tidal and storm surges (Ingram et al. 2006). Besides such structural there are also non-structural measures. Non-structural measures could be hazard forecasting and early warning systems to know when to evacuate the hazards prone people. Risk consequence reduction can also include public trainings to change the people's awareness. By doing this the people know how to behave in the case of a hazard.

The third mitigation goal is risk avoidance. Risk avoidance takes place when risk likelihood and consequence are still too high after they have been reduced. This means people get relocated and therefore permanently evacuated from hazard prone areas. This relocation does not include full risk ineffectiveness for the people but the risk will be minimised. Especially relocation from flood prone areas, volcanoes, avalanche chutes or landslide zones are examples. Risk acceptance is a mitigation process where people rather endure the risk they are facing then to mitigate it. People living on a floodplain expect to be flooded and they will bear the damages caused by the flood due to the good side effects like fertile soil for plant cultivations. These people do not even try to alter the causes of disaster. Often a cost-benefit analysis of possible risk reduction measures turns out to be not cost effective. Sometimes they will use other measures for different hazards where they see a greater value. It can also happen that some mitigations measures entail undesirable consequences. The impacts from a disaster are then seen less damaging then the consequences. Additionally in some cases cultural or other reasons make the people stay despite certain risks (Coppola 2015).
The last goal of risk mitigation is risk transfer, sharing or spreading. Especially financial losses caused by the disaster is covered in this action. Via insurances disaster losses can be transferred and spread by individuals or communities affected. The people have financial security with insurances transferring parts of monetary losses. In developing countries however there is hardly any insurance against ‘natural disasters’. In these countries it is more common that the people have rehabilitation and relief assistance offered by both private agencies and the public. It is even assumed that the availability of emergency relief works against the implementation of insurances in these countries. Another way to offset disaster losses is a community-based support. This can happen in forms of cash, in kind or in labour by the home community or friends and relatives (Paul 2011).

As already mentioned in the five goals of mitigation there are structural and non-structural types of mitigation. Examples for structural types of mitigation are resistant constructions, building codes and regulation measures, relocations, structural modifications, construction of community shelter or detection systems to recognise hazards earlier. On the other hand there are non-structural mitigation measures. These could be regulatory measures, community awareness and education programmes, non-structural physical modifications (securing of furniture, pictures etc. in case of earthquakes not to fall down or securing projectiles like furniture or stored wood in case of tornadoes not to fly around), environmental control or behavioural modification.

Especially three non-structural regulatory measures will be mentioned here due to the importance for this master thesis with the linkage to environmental issues. The first measure is land use management (zoning). "This is a legally restriction on how land may be used. It may apply to specific geographic designations, such as coastal zone management, hillside or slope management, floodplain development restrictions, or microclimatic sitting of structures (such as placing structures only on the leeward side of a hill)" (Coppola 2015, p.244). This measure influences the use of land and therefore can prevent areas from being misused and increase the resilience of the environment and with that decreases the impact of a ‘natural disaster’.

The second measure is protective resource preservation. This measure will be applied when new hazards will be created by disturbing land that has not been at risk from a hazard before. Protective resource preservation can be the protection of forests that help to preserve wetlands and block winds. This measure again helps to lessen the effect of a ‘natural disaster’ and raise the resilience of nature. The severity of a disaster will significantly increase if there is no or hardly any protective resource preservation.
The third measure is environmental protection regulations. "Certain environmental features, such as rivers, streams, lakes, and wetlands, play an important part in reducing the vulnerability of a community or country. Preventing certain behaviours such as dumping or polluting helps to ensure that these resources continue to offer their risk-reduction benefits" (Coppola 2015, p.246). Especially the risk-reduction benefits of these resources and of the resource environment are of special interest and help to bring the idea of mitigation to a new level away from strict physical constructions. These three examples also link to the whole theme of the master thesis. Environment plays a key role in when dealing with 'natural disaster'. Not only in the aftermath but also as a prevention to increase resilience and decrease vulnerability of the people.

This among other things was the reason for a criticism of mitigation measures. Most of the time physical mitigation measures were very costly and it was hard to find funds to implement the projects like flood protection or dams (Paul, 2011). Further a top-down approach is generally used and that leads to a limited inclusion of local and affected people. This all happens at the expense of vulnerable people of the society. Next the emphasis usually has been on physical measures and hardly on social changes to counteract threats by natural hazards. These measures were focused on reducing a specific hazard and not focused on minimizing the vulnerability of weak groups. Paul (2011) supports this idea by saying that "reduction in vulnerability is necessary to build future resilience against hazards and disasters" (Paul 2011, p.169).

Another problem is the resistance of many affected people against any alteration of their living environment. They do not see the necessity for land use change or new construction regulations. The people and their community are often unwilling to alter. Nevertheless these measures bring security to communities and make them safer places. The increase in safety brings proceeding benefits, in case of disasters, with it like lower reconstruction costs, shorter reconstruction time, short closure of local businesses or fewer repairs of public facilities. When talking about mitigation these problems can always come up (Paul 2011).

4.3.4 Disaster Preparedness

The last phase of the disaster management cycle is the preparation or preparedness phase. "Preparedness refers to the degree of alertness and readiness of an individual, a household, or a community against an impending disaster" (Paul 2011, p.169). These actions are taken in advance to have adequate response after the disaster. The aim is that everyone knows what to do after a disaster and how to carry out what needs to be done. This should happen with right tools,
proper equipment and enough information to act efficiently. With right precautionary measures the adverse effects of a disaster should be minimised during preparedness and that should ensure a timely, efficient and appropriate organisation together with relief and response actions. It can take up to years before the preparedness process achieves a satisfactory level (Coppola 2015).

To get an idea about the actions taking place during the preparedness phase some examples are given. It could be the provision of hazard warnings, formulating, exercising and testing disaster plans, evacuating people from areas at risk, communicating about vulnerability and possible reduction methods with the public and others, providing disaster training for the public and emergency responders or carrying out emergency response drills. Linked to these actions the acquisition of equipment for sufficient emergency actions is also very important to make sure that response is able to happen within a short matter of time. Like the structural and non-structural types of mitigation you can divide preparedness into physical and social preparedness. Physical preparedness means to make sure that the facilities and structures, which take actions can withstand the impacts of a disaster plus the buildings and their contents will not harm any people or properties. Social preparedness instead deals with actions to have an adequate community response to the needs of victims in the case of a disaster. This could be the information of different state and federal programs, which are available during disasters, understanding hazard warning and evacuation, managing a system to keep records about emergencies or the development of a disaster plan. Physical and social preparedness flow into the five phases of the preparedness cycle consisting of: raising awareness, conducting hazards and vulnerability assessments, improving knowledge about hazard and how to cope with them, planning and practice (Tierney, Lindell, and Perry 2001).

The first step of the preparedness process is a vulnerability analysis to identify what kind of hazard could occur at a particular place. Further a risk analysis is done to identify possible problems an extreme event could initiate. Again a distinction should be made between government preparedness and public preparedness. There is a certain amount of expectations in all nations that a government will take actions in the case of a ‘natural disaster’. Likewise many governments made promises to their constituents that response need will be met however this will only be verified if a disaster actually strikes. The five general groups of government preparedness are planning, exercise, training, equipment and statutory (Coppola 2015).

Bridging over to PDNAs there are PDNA trainings offered to teach people from the government how to act in the case of a ‘natural disaster’ and how to implement a PDNA. The government itself can decide whether to send someone to one of these trainings at different places.
worldwide or not. This is one side of being prepared. The other side is public preparedness. It is the idea of empowering normal citizens who can help themselves, their neighbours, their families and strangers. This will work if the citizens were given the skills to take particular action like searching and rescuing people or giving first aid. In recent years the public knowledge increased due to a propagated actions by governments. Before it was inconceivable that the public could be trained to a certain kind of level to act correctly after a disaster. So there will be more focus in future on the development of public awareness and preparedness. This could happen by public education, changing the awareness, changing the behaviour and warning the people if their risk situation has changed. Especially the media have a big influence in public education (Coppola 2015). With the changing risk situations the progressive development of early warning systems should be also mentioned here. Good early warning could protect people from getting harmed by 'natural disasters' or could lead to organised evacuation or preparations before a disaster. The important bit is a good, analytic and scientific forecast followed by a clear warning of the people and their appropriate reaction (Dikau and Pohl 2007).

4.4 International Disaster Management

The idea of global help can be equated with international disaster management. There are two views on international disaster management One view is the study of the different and various disaster and emergency management structures and systems all over the world. The other one is the study of disaster management when a single nation’s capacities of response mechanism are overwhelmed. There is not one "right way" of executing international disaster management because every country is unique and differs in its vulnerabilities, perception to risk, institutions and structures to manage risk, statutory authorities guiding risk management and disaster response mechanisms and the capacity of those. It is important to understand that not every ‘natural disaster’ in the world calls up international disaster management (Paul 2011). Only if one or several nations, depending on the type of disaster, cannot handle the effects of a disaster by themselves and the response capacities and structures exceed their maximums international disaster management is needed. The affected country will call upon the help of the international response community for international disaster management.

Over the last 30 years international disaster management has developed from a rather badly organised and ad hoc action to a highly effective apparatus. This also results from the high amount of different participants influencing international disaster management like the victims, local first responders, local government, governments from other countries, international organisations, international financial institutions, regional organisations and associations, non-
profit organisations, private businesses and industry organisations and local and regional donors. The expertise and help from all of them supports an extensive disaster management. It has to be added "that disasters do not become international just because they have overwhelmed a country’s capacity to respond. There must be a commitment on the participants’ part to recognize the need for international involvement and to accept the appeal made by the host nation’s government" (Coppola 2015, p.14). It is also important to say that response and recovery alone are not effective ways of managing disasters unless they are performed in a process with mitigation and preparedness activities. The focal shift from disaster response to disaster prevention by the international disaster management community shows the proof of widespread acceptance and recognition of this. And with the IDNDR even developing countries improved their pre-disaster management activities. Today the United Nations Office guides the disaster management mission of the international community for Disaster Reduction (UNISDR). As shown in chapter 4.2 the main focus of the UNISDR is building disaster resilience to communities by making the people aware of the importance of disaster reduction (UNISDR n.d.). The Global Platform for Disaster Risk Reduction (UNISDR) increased the global awareness how important activities for risk reduction are. In recent years the world leaders have begun to understand that many effects and impacts of disasters, in rich and poor countries, could have been reduced by more and better mitigation and preparedness actions. Therefore international disaster management is now in a position where they can influence these leaders not like ever before (Coppola 2015).

4.4.1 Actors in international disaster management and PDNAs

To understand who is participating in international disaster management the main actors will be introduced now with a focus on their involvement in PDNAs. To mention all participants in international disaster management one by one would go beyond the scope of this master thesis. The main participants can be divided in two main groups. One of them are multilateral organisations which are composed of sovereign governments and the other group are international financial institutions which are banks composed of sovereign member states. Concerning PDNAs there is another group to mention. These are, similar to multilateral organisations, governing organisations of a regional scale where regional can mean a whole continent.

The most important multilateral or intergovernmental organisation is the United Nations (UN). It is "the organisation most involved in the mitigation of, preparedness for, response to, and recovery from disasters around the world" (Coppola 2015, p.588). The UN system is widely
ramified with several programmes, offices and specialised agencies all over the world. Important actors also for PDNAs are programmes like the United Nations Development Programme (UNDP), the United Nations Human Settlements Programme (UN-HABITAT) and the United Nations Environment Programme (UNEP). An important office for PDNAs is the Office for the Coordination of Humanitarian Affairs (OCHA), which plays a big role in disaster management. Influential specialised agencies of the UN are the Food and Agriculture Organization of the United Nations (FAO), the International Labour Organization (ILO) and the World Health Organization (WHO). These specialised agencies are autonomous bodies that were created by intergovernmental agreement. All of these bodies have to report to several UN organs. While the UN programmes have to report to the General Assembly, which represents all UN member states, the different offices have to report to the secretariat that carries out the UN’s day-to-day work. The specialised and autonomous agencies have to report to the economic and social council instead which deals with international economic and social issues. The UN does not only work with governments, the private sector, NGOs and citizens after a ‘natural disaster’ took place but also helps to develop disaster risk reduction measures in advance. With a growing number of ‘natural disasters’ the UN’s importance is likely to increase. Important to mention is the fact that all actions by the UN only take place after the local government agreed the UN’s support. Advices by the UN are not mandatory and therefore the power of the UN is limited to the degree of the local government accepting and following the advices (Coppola 2015).

One main actor in disaster management and PDNAs is the European Union (EU). It now represents 28 (with the UK) member states and supports regional cooperation. The main point where the EU has influence in international disaster management is humanitarian assistance, which has been part of the EU mission since 1992. The EU’s work has grown to that extent “that today it is the world’s most significant humanitarian aid donor” (Coppola 2015, p.644). Over 50% of the world’s humanitarian aid is financed by the EU. This is also because the EU represents a big amount of the global economy. The EU became one of the active stakeholders regarding international disaster management. The EU has responded to disasters in more than 140 countries via various departments. In 2010 the EU went further and merged two divisions from the global hazard risk and disaster management section. One of them focuses on civil protection and the other focuses on humanitarian assistance. They combined it to the Directorate General for Humanitarian Aid and Civil Protection (ECHO). The confusing acronym comes from a former EU response mechanism called the European Community Humanitarian Office. With the ECHO the EU is now able to respond to most major ‘natural disasters’ anywhere in the world. In recent years up to 1.35 billion US$ were allocated by the EU for humanitarian operations. Meanwhile ECHO staff is spread in 38 countries worldwide and as a disaster strikes the ECHO staff will be deployed in order to carry out a needs assessment (Coppola 2015).
The international financial institution(s) (IFIs) involved in international disaster management supports financial and development cooperation worldwide by providing loans and by offering financial support to national governments. After a ‘natural disaster’ struck mainly developing countries request for emergency loans to fund the expensive rehabilitation and reconstruction costs. Without the IFIs most developing countries would not have the resources to recover from ‘natural disasters’. In the case of PDNAs mainly the World Bank is involved. The World Bank is one of the largest development lenders worldwide with loans of 52.6 billion US$ in 2013. The World Bank comprises several institutions known as the World Bank Group (WBG) which are the International Bank for Reconstruction and Development, the International Development Association, the International Finance Corporation, the Multilateral Investment Guarantee Agency and the International Centre for Settlement of Investment Disputes (Coppola 2015). The World Bank tries to reduce poverty by supporting the poorest countries and people and by helping developing countries to achieve a stable, equitable and sustainable growth (Wagstaff 2001). Due to the increase in the occurrence of ‘natural disasters’ and with that more affected countries struggling with their finances, the World Bank takes on a more central role especially in reconstruction and mitigation. When ‘natural disasters’ take place and the World Bank is called for help, it will not take part in the initial response phase but starts to help by restarting production capabilities and by restoring damaged and destroyed infrastructure. There might be assistance by a World Bank team to assess initial impacts and with that estimate financial losses. These losses then lead to estimations in reconstruction costs and costs for improved disaster mitigation measures. In PDNAs next to the World Bank some other financial institutions are partially involved, depending on the continent where the ‘natural disaster’ took place. This could be e.g. the Asian Development Bank (ADB), the Inter-American Development Bank (IADB), the African Development Bank (AfDB), the Caribbean Development Bank (CDB) or the Islamic Development Bank (IDB) (Coppola 2015). In recent years criticism on the WB rose due to human rights abusing projects financed by the WB (ORF, 2012).

4.4.2 Disaster Assessments

In general disaster assessments can be grouped in two categories. On the one hand there are situation assessments, or also called damage assessments, which try to determine the consequences caused by the disaster. On the other hand there are needs assessments, important in this case, which are "gathering data on the services, resources, and other assistance that are required to address the disaster. It is used to determine what is needed to both save and sustain lives" (Coppola 2015, p.333).
There is a range of methods used by disaster managers to carry out such needs assessments. These methods could be gathering of internal information, visual inspection, sample surveys, sentinel surveillance, detailed critical sector assessments by specialists, ongoing interviews or interviewing of informants. All the information for a needs assessment is coming from some kind of data sets. These data sets could be pre-existing or could be acquired after the disaster. Pre-existing data could be e.g. land use patterns and surveys, population and social demographics, infrastructure master plans, inventories or blueprints, hydrologic and geologic surveys, local, national and regional maps, historical hazard maps or emergency management resource inventories. Newly acquired data could be e.g. seismic event shake maps, meteorological data, flood gauge reading, casualty counts, damage reports or commodities (Coppola, 2015). Participants who are managing and coordinating such needs assessments should know with relative certainty some basic facts like e.g. what is happening, the place where it is happening, things which are needed, what is required to translate those needs, and what kind of resources are already available. Obviously these information tend to be more difficult to gather when the size and scope of the disaster increases. Especially the relevance, reliability and timeliness of the data and information are of supreme importance. The importance of good information should be illustrated by the quote from OCHA in 2006. "While good assessment information does not guarantee a good response, poor assessment information almost certainly guarantees a bad one" (OCHA 2006).

It has to be taken into account that the data and information for the assessment come from different stakeholders who have different operational biases, areas of concern, assumptions, limitations and capabilities. These facts will not simplify the data gathering process. The initiation and organisation of such assessments can happen at a jurisdictional level, either local or national, and then be coordinated with private and nongovernmental sector partners and with an increasing degree of the general public. To do so there are some requirements for an effective disaster assessment like dedicated financial resources, coordination and communication mechanisms, ample trained staff, data standards, assessment objectives, collection protocols and tools, proper equipment and supply and validation methods.

There are several different needs assessments. One is the Post Disaster Needs Assessment (PDNA) which is the main assessment analysed in this master thesis. Next to the PDNA there is the Damage and Loss Assessment (DaLa) developed by the UN Economic Commission for Latin America and the Caribbean (UN-ECLAC). Next there is the Human Recovery Needs Assessment (HRNA). The HRNA focuses on the impact of 'natural disasters' on people and how people meet their needs after a disaster. The latest needs assessment is the Post Conflict Needs Assessment (PCNA) which was already implemented in the Ukraine crisis and tragically gets more attention.
4.5 Post Disaster Needs Assessment (PDNA)

The main focus in this master thesis is on Post Disaster Needs Assessments. PDNA turned out to be a comprehensive and well working tool due to the PDNA guidelines that were thoroughly created. "The PDNA Guide includes the main elements of the Damage and Loss Assessment (DaLA) method and the Human Recovery Needs Assessment (HRNA) approach and process for a comprehensive assessment of damages, losses and needs, which would lead to the development of a Recovery Strategy" (UNDG, World Bank, and EU 2013, p.14). The PDNA guidelines are also a working process and can be improved, expanded and updated regularly from all agencies of the UN, WB and EU as well as from governments, affected communities and partners.

The PDNA guidelines are divided in Volume A and Volume B. In 2008 it was agreed by the EU, the World Bank and the UNDG (United Nations Development Group) to mobilise resources and member institutions with the aim to harmonise methods of post-disaster assessments to better support affected populations and governments due to 'natural disasters' with a coordinated approach. Even though the guidelines were finalised and released in 2013 they were used since 2008. The reason for the EU, WB and UN to develop another post-disaster assessment was the multiplicity of parallel needs assessments conducted by several different groups, agencies and donors after a 'natural disaster'. There was a great variety in the scope and rigor of these different disaster assessments as well as the different time periods they were carried out during disaster response and recovery. The PDNA guide should especially provide a common platform for coordination and partnership in recovery planning and post-disaster assessments. In the PDNA Guidelines Volume A it says, "the overarching purpose of the PDNA Guide is to provide improved support to governments in post-disaster recovery assessments and planning through a more coordinated approach. The more immediate objective of the Guide is to provide an agreed framework and predictable arrangements for effective and efficient coordinated support from the EU, the UN and the WB to governments requesting international assistance for post-disaster recovery and reconstruction" (UNDG, World Bank, and EU 2013, p.10). The PDNA guide provides guide in different critical areas. These are as stated in the PDNA Guidelines Volume A:

- "Present common minimum standards regarding quality, reliability and inclusiveness
- Facilitate quick decision-making and action by stakeholders
- Provide a predictable and coherent approach to assessment and planning
- Contribute towards producing an objective and comprehensive estimate of recovery needs
- Contribute towards an efficient professional response by the international community
- Contribute to a more cost-effective approach by working towards coordination, reducing overlaps
- Improve the credibility of assessments and recovery strategies
- *Improve financing opportunities for recovery and reconstruction* (UNDG, World Bank, and EU 2013, p.10)

The PDNA guide is primarily for those who are participating and coordinating the implementation of PDNAs. These people could be senior governments officials, senior managers and technical staff from multilateral agencies and stakeholders or the civil society who have a function in the implementation of PDNAs. While the PDNA Guidelines Volume A would be of more interest for the senior government officials and senior managers the PDNA Guidelines Volume B are more useful for technical staff and experts who are working on sector specific assessments. The PDNA guidelines are still limited and do not intend to replace any better elaborated methods used and developed by the WB and UN. It is aware that there might be the need for a more in depth assessment that goes beyond the scope of a PDNA. And especially sector specific recovery programmes and strategies might be needed and carried out by agencies, IFIs or donors afterwards. Further the PDNA guide is not intended to be all-encompassing and comprehensive nor is it prescriptive. "Rather, it provides an overarching approach and orientation towards assessment and initiating the recovery planning process which would be of use to a wide audience" (UNDG, World Bank, and EU 2013, p.11).

As already mentioned the PDNA guide consist of two different Volumes which are Volume A and Volume B. Volume A gives an introduction to the guide and outlines the main objectives, principles and deliverables. Further it provides the framework for PDNAs and the guidance on the PDNA process. Additionally there is a toolkit in Volume A which provides useful instruments to support the PDNA process. The PDNA Guidelines Volume B give guidance to 18 different sub-sectors. These sub-sectors are grouped in four different sectors as followed:

- Social Sectors: Housing and Settlements; Education; Health; and Culture
- Productive Sectors: Agriculture, livestock, fisheries & forestry; Commerce & trade; Manufacturing; and Tourism
- Infrastructure Sectors: Water, sanitation & hygiene (WASH); Community infrastructure; Transport; and Telecommunications
- Cross-cutting Sectors: Disaster Risk Reduction (DRR); Employment, livelihood & social protection; Environment; Gender; Governance; and Macroeconomic impact of disasters

All of these sub-sectors have an own PDNA Guideline Volume B going into more detail about the exact implementation. Therefore each sector produces an own integrated summary of damages, losses and needs. The social, productive and infrastructure sectors all contain thematic relevant sub-sectors. The cross-cutting sub-sectors however cannot be linked to one special sector and moreover use and need data and information from the other sub-sectors. For example the sub-sector environment might has to work closely with the sub-sectors Agriculture, livestock,
fisheries & forestry, Water, sanitation and hygiene or Disaster Risk Reduction that can all flow into the topic of environment. Figure B shows topics involved in PDNAs where also other thematic areas then the social, productive, infrastructure and cross-cutting sectors will be taken into account to achieve a most comprehensive assessment as possible. Going away from the PDNA guide there should also be a focus on the PDNA itself. When you look at the PDNA Guidelines Volume A there are different sub-sectors written down then actually exist. Since PDNAs are a developing process some sub-sectors have been renamed or removed. In the case of this master thesis the latest version of PDNA Guideline Volume B is considered. This point is also important for the evaluation of the data because when the online questionnaire was done the sub-sectors from the PDNA Guideline Volume A were used. In this case inconsistencies could occur but will not change the message of the respondents in the questions. The objective of a PDNA is to assist and support a local government when its coping capacities are exceeded by the impacts of a ‘natural disaster’. Further on the basis of that a sustainable recovery strategy should be developed with the aim to mobilise technical and financial resources. And if it needs more technical, financial or institutional support they can request for it with external assistance and cooperation. In the PDNA Guideline Volume A six aims of a PDNA are specifically stated:

Figure 8: Sectors assessed in PDNAs (adapted from UNDG, World Bank, and EU 2013, p.13)
- "Support country-led assessments and initiate recovery planning processes through a coordinated inter-institutional platform integrating the concerted efforts of the UN system, the EU, the WB, other participating international donors, financial institutions, and NGOs;

- Evaluate the effect of the disaster on:
  - Infrastructure and assets
  - Service delivery and access to goods and services across all sectors, particularly the availability of basic services and the quality of service delivery;
  - Governance and social processes;
  - Assessing needs to address underlying risks and vulnerabilities so as to reduce risk and build back better (BBB).

- Estimating the damage and loss caused by the disaster to physical infrastructures, productive sectors and the economy, including an assessment of its macro-economic consequences;

- Identify all recovery and reconstruction needs;

- Develop the Recovery Strategy outlining priority needs, recovery interventions, expected outputs and the cost of recovery and reconstruction which would form the basis for a comprehensive Recovery Framework;

- Provide the basis for mobilizing resources for recovery and reconstruction through local, national and international sources". (UNDG, World Bank, and EU 2013, p.12–13)

There are four deliverables. First of all one merged assessment report should be worked out based on all sub-sector reports. These reports should show all damages and losses, impacts and effects of each sub-sector and further should state the recovery needs. The report should also include the explicit impacts for the cross-cutting sub-sectors with an environmental consideration, a gender perspective, governance and risk reduction. Secondly a recovery strategy should be issued with a vision for national recovery. This should include the timeframe, costs, objectives, interventions and expected results. Thirdly a PDNA should produce the basis for mobilisation of recovery resources with a donor conference if required. And at last provide "a design for a country-led implementation mechanism for recovery" (UNDG, World Bank, and EU 2013, p.14).

Another factor important for the process of a PDNA are the participants and the coordination, which are essential for the development of a recovery strategy. A PDNA is a government-owned and government-led process which is based on and supported by national and international actors and experts. To make sure the process is government-led government representatives from relevant ministries should be involved and included in both the managements and
technical teams. It is also recommended that the national government leads the high level teams of UN, WB and EU and that the local and affected population should also be involved next to the civil society, local authorities and the private sector. With that quality and amount of participants a PDNA can produce the best possible recovery strategy. "Furthermore, the PDNA may engage all other relevant international actors, including the International Federation of Red Cross and Red Crescent (IFRC) and other NGOs, and donors where appropriate. It is important that all national and international stakeholders participate at all stages of the assessment process, including the development of the Recovery Strategy. It is desirable to have a donor engagement in the PDNA as this donor involvement brings international experience to the assessment" (UNDG, World Bank, and EU 2013, p.15). A sample of national and international actors participating in PDNAs is shown in table 3. Special attention should be given to the recovery strategy and needs. Due to the fact that PDNAs are completed in a very short period of time countries would often require a more comprehensive recovery planning especially when the ‘natural disaster’ has a large scale. For that reason the World Bank’s Global Facility for Disaster Reduction and Recovery (GFDRR) (a partnership to help developing countries to reduce and understand their vulnerability to natural hazards with a link to climate change), the EU and UNDP produced the guide to Developing Disaster Recovery Frameworks. They saw the necessity because "instruments such as the Post-Disaster Needs Assessment (PDNA) provide a solid basis for quantifying recovery needs and formulating broad strategies. However, experience in the last

Table 3: Illustrative sample of national and international actors participating in PDNAs (UNDG, World Bank, and EU 2013, p.16)

<table>
<thead>
<tr>
<th>National Actors</th>
<th>International Actors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presidential Office or equivalent</td>
<td>EU</td>
</tr>
<tr>
<td>The Ministry of Finance</td>
<td>WB and other IFIs</td>
</tr>
<tr>
<td>The Ministry of Planning or equivalent</td>
<td>UN agencies</td>
</tr>
<tr>
<td>Line ministries</td>
<td>Other bilateral donors</td>
</tr>
<tr>
<td>Civil Defence</td>
<td>International NGOs</td>
</tr>
<tr>
<td>Governors, senators and mayors</td>
<td>Regional International Organisations</td>
</tr>
<tr>
<td>National Red Cross</td>
<td></td>
</tr>
<tr>
<td>National NGOs</td>
<td></td>
</tr>
<tr>
<td>Civil society organisations</td>
<td></td>
</tr>
<tr>
<td>Community-based organisations</td>
<td></td>
</tr>
<tr>
<td>Affected population</td>
<td></td>
</tr>
<tr>
<td>Private sector</td>
<td></td>
</tr>
</tbody>
</table>
several decades has shown that meeting recovery needs must go beyond simply conducting post-disaster assessments" (GFDRR et al. 2015, p.VIII).

The process of a PDNA should take from six to twelve weeks. Many different actions are involved going from the preparation to the data collection over to the analysis and the formulation of a recovery strategy. The whole process is shown in figure 9. In the upper row you can see the Actions happening during a PDNA (while HQ means headquarters level among UN, WB and EU) and in the lower row you can see which methods are used to carry out these actions. On the bottom of the figure you see a timescale and the approximate time each actions needs. This process as shown in figure 9 would be the perfect process. In the end all actions will be carried out, however with different preconditions depending on several factors like availability of experts, access to data and information or the severity and scope of the disaster. Therefore the PDNA tool cannot be implemented the same way every time.

![Figure 9: Post Disaster Needs Assessment Process (adapted from UNDG, World Bank, and EU 2013, p.50)](image-url)
4.5.1 The sub-sector environment

This sub-chapter will present the PDNA Guideline Volume B from the Environmental sub-sector. Further the importance of environment will be demonstrated in disaster recovery.

As stated in the environment PDNA Guideline Volume B "the main objective of PDNA–Environment is to prepare a recovery strategy that guides the restoration of environment and natural resources damaged due to a disaster. This should also enable environmentally friendly rebuilding in all sectors. The recovery plan also supports the restoration of environment and natural resources as a disaster risk reduction (DRR) strategy" (GFDRR et al. 2013, p.2). Due to the fact that environment is omnipresent and cross-cutting it affects both social and economic activities. This will lead to a need of close cooperation between the Environment PDNA team (ENA) and other sub-sector teams with the participation in key consultations. Further it should avoid repetition in the PDNA process. The Environment PDNA Guideline Volume B "contributes to the methodology for post-disaster assessment by strengthening the estimation of needs for human development recovery; governance and institutional capacity; disaster risk reduction as it relates to the environment; and access issues associated with a post-disaster situation" (GFDRR et al. 2013, p.2).

If the decision has been made to conduct a PDNA for the environmental sub-sector the first thing to do is a scoping exercise. This will gather data about the type of disaster, intensity and geographical scope, the population impacted by the disaster, key environmental segments impacted, key institutions involved in environmental governance, key stakeholders involved in the rescue and relief operations, the overall scope and timeline for the PDNA and possible sources of required data. The data collection itself is always the hardest part and many different methods will be consulted like base maps, satellite images or local knowledge. The main aim is to find out where the impacts of the disaster has been most severe, localise areas that may be at further risk, identify the measure which might be needed to mitigate further impacts on environment, identify the stakeholders and institutions who might be impacted and need to be consulted and to identify the typical services provided by the environment. The strategy with data is rather to work with less then with the ideal data and to complete data gaps with remote sensing, primary data gathering and expert judgement. Especially in the environmental sub-sector pre-disaster information are of high importance to identify the damages and losses. Key sources to gather pre-disaster information are e.g. environmental profiles for the region/country, satellite images and maps, project reports from national and international environmental agencies, local knowledge on natural resources management, previous environment-related assessments, wildlife and fisheries management plans, housing and related
development plans, land tenure records or the population living in and around national natural resources (GFDRR et al. 2013).

At the same time special attention needs to be given to protected areas that provide special services. These areas are national parks, nature reserves and hunting reserves, UNESCO World Heritage Sites, marine reserves, ramsar sites (wetlands of international importance), wildlife corridors and watersheds or other ecosystems providing vital services. Ecosystems play a key role in the sub-sector environment and provide a range of services, important for the people living next to it, which you can see in figure 10. They have provisioning services for the people providing e.g. food, fresh water, fuel wood, fibre and biochemicals. Additionally ecosystems have regulating services by regulating climate, disease and water next to cultural services like recreation, ecotourism or spiritual and religious services. Ecosystem services are important in post-disaster phases to sustain the local population (Renaud, Sudmeier-Rieux, and Estrella 2013).

At this point it will be emphasised again that it is important to understand that disasters do not just damage the environment but environmental degradation also aggravates and intensifies the effects of natural hazards. Scientists even go further by saying not just the intensity but also the frequency get enhanced by environmental change and environmental degradation (Tran and Shaw 2012; Renaud, Sudmeier-Rieux, and Estrella 2013). To make the people participating in

![Figure 10: Ecosystem services (adapted from MEA 2005, VI)](image-url)
PDNAs aware of that the Environment PDNA Guideline Volume B states some environmental drivers of disaster risks. These environmental drivers of disasters are shown in table 4.

Table 4: Environmental drivers of disasters (GFDRR et al. 2013, p.11)

<table>
<thead>
<tr>
<th>Environmental drivers</th>
<th>Type of disaster caused or exacerbated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deforestation</td>
<td>Landslide, flash floods, droughts through desertification</td>
</tr>
<tr>
<td>Coral reef damage</td>
<td>Storm surge</td>
</tr>
<tr>
<td>Conversion of wetlands</td>
<td>Floods</td>
</tr>
<tr>
<td>Monocultures forestry</td>
<td>Forest fires, landslides</td>
</tr>
<tr>
<td>Mangrove damage</td>
<td>Floods, storm surges, coastal erosion</td>
</tr>
<tr>
<td>Damage to sea grass</td>
<td>Beach erosion</td>
</tr>
</tbody>
</table>

Aggravating the IPCC already said in 2012 that ecosystem degradation is one of the main drivers for the climate change (IPCC 2012). And with repeating occurrences of hazards the importance of the environmental sub-sector will hopefully grow to achieve a higher degree of resilience and to lower vulnerability of ecosystems and the people. A better environmental consideration is also needed to avoid side effects by ‘natural disasters’. If a forest is affected by a cyclone the people will not only be affected by the direct impact of the cyclone but will also be threatened by landslides at the next heavy rainfall. If the environment, in that case the process of reforestation, is not factored, the disaster recovery is incomplete and not sufficient enough.

4.5.2 Challenges of the sub-sector environment

Pursuing from the previous chapter the challenges of the sub-sector environment are shown. For the sub-sector environment the situation is also aggravated with mostly developing countries requesting for international disaster management. And this fact is also picked up by the Environment PDNA Guideline Volume B by saying that "the lower levels of economic development in poorer or developing countries may have led to under-investments in protecting environment and natural resources before the disaster. These may have contributed to the severity of disaster impacts as a consequence of natural hazards. However, the disaster could drastically reduce the level of human development, and this may lead to a further decline in the willingness to protect the environment after the disaster. The environment could become a low-priority item, even if the deterioration of natural resources could negatively affect the rebuilding of livelihoods of people after the disaster" (GFDRR et al. 2013, p.14). This dilemma is probably the biggest problem for the environmental sub-sector.
The outcome of the needs assessment should be a detailed report. This should include the effects and impacts on the environment caused by the ‘natural disaster’, the sector’s recovery plan, the changes and damages in economic flows and the needs and costs for rebuilding the environment. Even though the combined PDNA document will not contain everything factored in the environmental sector report and will only give cost estimations and recommendations for the environment sub-sector, it is recommended that the other information will be published as an annex or a supplement to the main report. The reasonably small team, which works on the environmental sub-sector, should consist of environmental experts under the coordination of a team leader. These experts should have specialised domain knowledge on key environmental segments that were identified in the scoping exercise. The team leader should also have a clear understanding of the overall PDNA process (GFDRR et al. 2013).

The cooperation between the several sub-sectors gets clearer in table 5 where sectoral overlaps and integration of environmental issues are shown. This highlights on how many other sub-sector’s data and working process’s a good environmental assessment relies on. It also shows at what point the environmental sub-sector starts to continue the work of the other sub-sectors with other environmental issues already and parallel factored by the ENA team. "In an ideal case, the role of the environmental experts in the PDNA team is to verify from other sectors if the relevant environmental issue has been factored in and prompt and support them to do so if they have not. However, it is more common that other sectors are too busy concentrating on their “core” issues and environment and other cross-cutting themes are not given any attention. So environmental experts should be prepared to undertake assessment of these issues themselves and provide damage, loss and recovery figures to other sectors. Such an approach, in practice, gives a better chance for environmental issues to be factored into the final report" (GFDRR et al. 2013, p.14).

Linked to the last paragraph the idea of cross-cutting issues should be mentioned here. Cross cutting sub-sectors are affected by all or a significant number of sectors and are of high importance for post-disaster recovery. The interweaving nature of the environmental sub-sector was the reason to make environment a cross-cutting issue. To avoid repetition the ENA team has to be fully engaged with the other sub-sectors during the whole PDNA process. The idea is that all sectors incorporate cross-cutting issues in their assessment process and to include the recommended interventions in the recovery strategy. This 'wishful thinking' is written down in the PDNA Guidelines Volume A, however as quoted before the Environment PDNA Guideline Volume B already sees problems with the implementation of this process and the difficulty for other sub-sectors to integrate environmental issues in their process.
Table 5: Sectoral integration of environmental issues (GFDRR 2013, p.15)

<table>
<thead>
<tr>
<th>#</th>
<th>Environmental Issue</th>
<th>Sectoral Overlaps</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Surface/groundwater pollution</td>
<td>Water supply, sanitation and hygiene (WASH)</td>
</tr>
<tr>
<td>2</td>
<td>Disaster waste management</td>
<td>Infrastructure/Early Recovery/Employment</td>
</tr>
<tr>
<td>3</td>
<td>Healthcare waste management</td>
<td>Health</td>
</tr>
<tr>
<td>4</td>
<td>Damage to mangroves/wetlands</td>
<td>Agriculture</td>
</tr>
<tr>
<td>5</td>
<td>Damage to forests, soil</td>
<td>Agriculture and forestry</td>
</tr>
<tr>
<td>6</td>
<td>Waste management centres</td>
<td>Waste management systems infrastructure</td>
</tr>
<tr>
<td>7</td>
<td>Sewage systems and sewage treatment plants</td>
<td>Wastewater management infrastructure</td>
</tr>
<tr>
<td>8</td>
<td>Solid and liquid wastes from camps</td>
<td>WASH/camp coordination</td>
</tr>
<tr>
<td>9</td>
<td>Damaged facilities of environmental sector</td>
<td>Infrastructure</td>
</tr>
<tr>
<td>10</td>
<td>Environmental pollution from damaged industrial facilities</td>
<td>Labour/Infrastructure</td>
</tr>
<tr>
<td>11</td>
<td>World Heritage sites and national parks</td>
<td>Culture</td>
</tr>
</tbody>
</table>

Another issue which has to be focused on concerning the environmental sub-sector is the environmental footprint. This means all the activities during the humanitarian and relief phase and during the early recovery phase which might have an impact on the environment. This could be a waste disposal problem from the sanitation in survivor camps or an increase extraction from timber in the locality for heating and cooking. Other examples could be an over extraction of ground water, land degradation due to wrong cultivation, waste disposal problems from the camps or infrastructure reconstruction without looking at the environment (GFDRR et al. 2013).

The recovery strategy of the environmental sub-sector is "build back greener", and not "build back better" as mentioned in chapter 4.2. including a sufficient consultation of the affected people who directly depend on specific natural resources. This should be a fundamental element of the ENA process that will make sure that the people's own voices are heard together with the identification of their specific needs. The people now have the opportunity to contribute to the early recovery process and with their information and suggestions they will not separate between the sub-sectors but will refer to the overall conditions which will make it a big cross-cutting issue (GFDRR et al. 2013). The environmental sub-sector is important in the comprehensive process of a PDNA but has still room for improvement. Therefore own research was done concerning this topic to analyse possible improvement measure. The next chapters will show the research.
5. PDNA - a tool with the attempt to perfection: Results and evaluation

This chapter presents the data analysis and the evaluation of the research questions. The structure will follow the narrowing structure of the research questions described in chapter 1.1. Starting with a general analysis how the international disaster community acts after 'natural disasters' followed by a narrowing to the PDNA tool and then continued to the specific topic of environment in PDNAs. The evaluation is concluded with a last chapter about recommendations for the environmental sub-sector.

5.1 An insight on international disaster community and ‘natural disasters’

The first superordinate issue coming up at the evaluation is how the international disaster management community deals with 'natural disasters'. This question is answered on the one hand based on literature (see also chapter 4.3 and 4.4), and on the other hand with the help of the expert interviews. This sub-chapter shows which process gets going after a 'natural disaster' happened and where PDNAs are situated in this process and serves as an integration of PDNAs in the whole disaster management topic.

Two main issues were mentioned by the interviewees concerning the handling of 'natural disasters' by the international disaster management community. The results are on the one hand a behavioural aspect about the change of attitude towards 'natural disasters' and on the other hand an exceptional aspect of more agencies and actors involved today. The change of attitude towards 'natural disasters' is an ongoing process moving away from a strict economical and infrastructural assessment of damages to a more social and environmental view on disaster management. Since the IDNDR and later the ISDR the focus was on risk reduction. Especially reducing losses of economic, human, social and environmental nature was emphasised. Since in this context a 'natural disaster' has already taken place or will strike again the emphasis in the aftermath of a 'natural disaster' should also be on economic, human, social and environmental issues. It turns out however that this is mostly not the fact and that disaster management is a very economically run practice. Interviewee 4 told that "there is this old conflict between to what extent we are covering only economic issues and to what extent are we including human development issues ". This problem is still bothering the international disaster management community to a certain extent. Experts involved in economic issues are potentially not bothered but all the other experts who get less attention see the necessity to also look at social and environmental issues. According to Interviewee 5 the situation has already changed. S/he said
that "definitely now there is more opportunity and recognition of the importance of environment then 15 years ago". This leads to the assumption that not only the environmental perception of the people but also of the governments, NGOs and international agencies changed. It could still be questioned if this degree of perception not only for environment but also for social issues is yet enough.

Often people involved with environment feel powerless compared to productive and infrastructural actors however sometime catastrophic events e.g. like the tsunami and the following nuclear disaster in Fukushima, Japan in 2011 changed the people's perception. In Baden-Württemberg, Germany the main winner of the state election in 2011 was the green party, also due to the nuclear catastrophe (dpa 2011). It shows that the focus of the international disaster management community might also change even more in future. This point is unfortunately only one side of the medal. The international disaster management community only has an advisory function and therefore can only suggest governments to consider certain topics. Governments however, especially in the countries where global help is requested, often focus on economic and infrastructural themes. Only if the local government's perception towards risk reduction and the components which lead to a good risk mitigation and resilience growth change, there will be the possibility that all important topics get enough attention. This can happen with good recommendations and consultation of the international disaster management community for the governments by showing them figures and former outcomes of a biased look at disaster management themes. The international disaster management community is aware that "there is nothing wrong with a focus on survival and recovery" as interviewee 2 said, but the process afterwards could be more balanced towards social and environmental aspects.

At PDNAs many different actors come together (chapter 4.4.1 and 4.5.1). This range of participants is seen as a strength (chapter 5.2). In the past needs assessments were mostly lead by the WB and with that a very economic view on disaster management developed. With more and more assessments made the international disaster management community began to understand that also human factors should be integrated, especially forced by UNDP. Interviewee 5 mentioned, "it is good that the EU, WB and UN and the national government is involved at one time". This mix of actors with different views on things, but with one common goal, makes the international disaster management multifaceted and broader based. The international disaster management community is therefore well positioned when it is facing 'natural disasters'. Not only the amount of people involved in different agencies but also the diverse point of views coming from them makes the management of disasters today more and
more balanced and comprehensive. In the end however, due to the capitalistic global community, it is all about the money.

All the needs presented in a PDNA report are just numbers of how much money the country requests. How much money the country will get is decided at the donor conference after the PDNA process. As interviewee 5 said, "these PDNAs are made for donor conferences", shows how powerful the donors are. In the end the greatest power is attributed to those actors who give the money. Therefore a bigger variety of actors enables the international disaster management community to work more comprehensive but does not prevent it from being controlled by the power of money. The point about the donors and the donor conference will also be picked up again in the next sub-chapter. Figure 11 shows the process how the international disaster management community deals with 'natural disaster'. A figure was made which combines actions of the disaster management cycle with PDNAs. The process of PDNAs should follow the humanitarian phase as the PDNA Guidelines Volume A suggests. Interviewee 4 supports this aim by saying "it is a logical connection to the humanitarian phase" and demonstrates with this statement that PDNAs are an useful tool in the process of disaster management. During PDNAs there are four main steps to handle the damages caused by the 'natural disaster':

- First the baseline information is gathered to know how the situation was before the 'natural disaster' and how big this gap is.
- Second the disaster effects is analysed which basically shows damages and losses. This is just a quantitative task that still has its problems because the reference to the total amount is often missing. If 100 houses are destroyed, are these 100 houses out of 1.000 or out of 10.000?
- Third the impact analysis is done, which has an economic but also a human development perspective and develops out of the disaster effect.
- Fourth the estimation of recovery and reconstruction needs where the long-term development for each sector is presented. This PDNA process is also shown in figure 9 in more detail and is summarised in figure 11 on the right side

After an assessment like PDNA took place money will be pledged to the affected country at the donor conference and with that money the reconstruction of the country conducted trough all sub-sectors can start. The last step should be an increase of risk mitigation in all different fields and a growth of disaster preparedness of the whole country. If these factors are fulfilled the country will experience less damages and losses if another 'natural disasters' strikes again. The central idea therefore should be to make the country resilient against 'natural disasters' and to install sustainable risk mitigation measures. And also the goal of the countries pledging money should not be a relationship like buyer and seller with the affected country. Even though today's
politics and countries are keen on gaining more power it should not happen at the expense of developing countries struggling with the effects of a ‘natural disaster’.

The main result from chapter 5.1 is the fact that there is an increase in social and environmental aspects considered in disaster management however it still has more room for recognition. This closely links to the fact that more actors in disaster management make the PDNA tool more comprehensive and includes more social and environmental issues. There is however still the fight for power by the donors and governments who most commonly pledge money to the affected country in their own interest. This must somehow be overcome and needs to get reduced.

5.2 Post Disaster Needs Assessment and its consideration in a disaster management context

After the overall context of the international disaster management was shown this chapter will go into more detail with a focus on PDNAs. Data for the analysis comes from the online questionnaire as well as from the expert interviews. Several statements were made in the online questionnaire and the respondents were asked to answer to what degree they agree with it. A
A wide range of possible strengths and weaknesses concerning PDNAs was covered with that method. In the expert interview especially the comprehensive and collaborative nature of PDNAs was mentioned very often next to the extensive process that makes PDNAs so valuable. A supportive function for governments, an easily understandable tool and the cooperation during PDNAs are other factors that made PDNAs gain consideration in the disaster management context.

In the expert interviews every interviewee mentioned the comprehensive and collaborative process of a PDNA as the biggest strength. Continuing the thoughts from chapter 5.1 the great amount of agencies involved in a PDNA makes it a very strong tool. As interviewee 5 said: *"The strength is that it brings together three key stakeholders in disaster risk reduction. It is good that the EU, the WB, the UN and the national government are involved at one time."* With that mix of agencies the PDNA tool tries to ensure that a broad range of topics is covered. While the WB and the local government are often focused on economic issues the UN system brings in social and environmental attention. While the emphasis is on getting quantitative numbers in a PDNA all non-quantitative issues will get less attention and will intensify an economical view during PDNAs. Event though agencies should not be restricted too much it is a fact that everyone will pursue their own interests. Maybe this also affects the overall coordination during a PDNA. The member state that is requesting a PDNA has the maximum influence and if they are not aware of PDNAs the WB and UN will take an active role for consulting. And they will help to coordinate the PDNA. Especially the coordination between the 18 sub-sectors involved is very important to avoid repetitions but also get the people together to work more efficiently. Figure 12 shows that more than 2/3 of the respondents from the online questionnaire think the overall coordination is adequate. This brings the assumption that the coordination during PDNAs still has room for improvement but will not be the reason for an insufficient PDNA. Linked to the coordination the cooperation will be dealt with later in this chapter when the process is analysed in more depth.

On the other side many agencies and actors need more time to gather in the affected country. This problem is also seen by interviewee 1 saying, *"because it is a collaborative process, multiple institutions have to come together so it takes more time"*. In the process of a PDNA where the participants have to come up with the assessment in three to four weeks every single day counts. If a special field is missing certain issues might not be considered and the comprehensiveness might get lost. In addition the great amount of actors make the PDNA also a bit stiff and inflexible. *"It is a quite heavy machinery"*. Interviewee 3 mentioned, *"it limits some of the flexibility"*. You can assume from that, that many actors are not always an advantage. It is rather the quality of expert than the quantity that makes a PDNA process successful. For this
purpose PDNA trainings take place with many different actors. Governments send people to those trainings to make them prepared in the case of a ‘natural disaster’ and the following PDNA. These people get trained for the sub-sector they are involved in and with that help the local government to usefully participate in PDNAs. Another fact, which should be guaranteed by the different actors, is objectivity. As interviewee 2 said, "having a mix of international experts and national experts together help provide objectivity". Facing this statement interviewee 4 said, "whoever wants to tell you that a PDNA is a technical objective process tells you nonsense. A PDNA is extremely political". Of course many actors will make a process like PDNA more objective but in the end everyone is following his own interests and with the following donor conference even the countries giving money have a political interest. Of course all the agencies involved in PDNAs will tell that they act in concert but unfortunately this is not the fact.

The next feature for PDNAs to be considered in disaster management is the strong methodology developed by UN, WB and EU. Both PDNA Guidelines Volume A and Volume B were developed to be clear and good structured. "PDNA is a tool which everyone understands" as interviewee 1 said. Not only the structure but also the scope covered is the key for a strong methodology. There is the PDNA Guidelines Volume A, which shows the overall process of PDNAs and there are 18 different PDNA Guideline Volume B for each sub-sector. And the division of these 18 sub-sector into "productive, infrastructure and cross-cutting sectors does make a lot of sense" according to interviewee 4, however it is important to not only make it an economic approach but to get the
emphasis on all sub-sectors. A barrier there could be complicated guidelines but as you can see in figure 13 more then 3/4 of the online questionnaire respondents think the PDNA Guidelines Volume B are mainly easy to understand. Even tough it seems clear that the PDNA guidelines should be easy to understand because so many different people get in touch with it, it is not self-evident. The development of the PDNA guidelines did not take up to 5 years without reason. And the guidelines should be updated regularly as interviewee 6 said "a sector guidance that I wrote some years ago has room for improvement if I look at it now". This just shows that the PDNA guidelines are a working process and can always be improved. By doing this the methodology can be adapted and stay strong.

A big limitation is the fact that the agencies involved in PDNAs can only make suggestions to the local government. Especially the UN system can only function as a consultant but cannot force the local government to implement certain things. At this point the affected government has the main power, as it is desired in a PDNA, and can override certain processes and not implement specific issues. Even tough most countries are happy getting help with the disaster management it is still a weak point of PDNAs that cannot be overcome. This advisory issue will be pursued in the next chapter when talking about the role of environment in PDNAs.

The next aspect, which makes PDNAs considerable in disaster management, is the process of PDNAs. There are several points that have to be mentioned when talking about the process. First are the preconditions of the process followed by the cooperation and how the government is
involved in the PDNA process and finished by the effects after the process. When talking about the preconditions attributes of the PDNA process are meant which are there before a 'natural disaster' takes place. A strength of the process is that there is only one assessment. Even tough a maximum of 18 different sub-sectors have to be put together in one report PDNAs are designed to work out like that. It is easier and more efficient if everyone acts in concert then to do its own thing. This is supported by the strong methodology that leaves the actors a certain scope of action but is still logical in its chronology and progression. Each sub-sectors aims to achieve certain goals stated in the guidelines and according to the respondents in the online questionnaire the implementation of these goals is most of the time easy but still 1/3 of the respondents think the implementation is partially difficult as shown in figure 14. That suggests that there is a disparity between the guidelines and the implementation on the ground. This derives from the problem with every guideline. The PDNA guidelines cannot cover every single possibility and eventuality happening during a PDNA. Not only the type of disaster or the scope but also the agencies involved and the experts on the spot can affect how easy feasible goals from the PDNA guidelines can be implemented. These difficulties are part of the game and are hardly changeable. This is why the involvement of the local government is of such a great importance so all the country-specific characteristics can be taken into account. How different circumstances involve the implementation of PDNAs is also shown in chapter 5.2.1.

The PDNA Guideline goals/aims of the sub-sector(s) I engage in are easy to implement.

![Pie chart showing the percentage of respondents' agreement with the statement.](figure14.png)

Figure 14: The implementation of PDNA guideline goals/aims (own figure)
The involvement of the local government in the whole process is an advantage of PDNAs. First the local government requesting the PDNA has the maximum influence as said before. Second PDNAs help the local government to understand the priorities and to identify them after the disaster so they are able to have an efficient disaster recovery. Third with the help of the government it is easier to implement a PDNA. According to interviewee 3 "it gives you more leverage with the government and you can discuss with the government. You can reach higher level officials. You get attention of the government because you [are] discussing it collectively. And it also gives you more logistics and resources". All these advantages flow into a good PDNA process and make PDNAs interesting for countries affected by a 'natural disaster'.

Due to the fact that every disaster is different only the methodological preconditions can be solidified but not what the PDNA actors have to expect in the affected country. For this reason the PDNA guidelines are well structured no matter which disaster stroke and to what extent it affects the country. When the PDNA starts especially the cooperation between the sub-sectors seems to be a great strength. Clearly every sub-sector has to do its own data gathering and has to do field visits and consult the local stakeholders. And normally they also have to do a lot of desk research because the baseline data is missing but following they have the possibility to cooperate with the other sub-sectors to exchange data and knowledge. This process is wanted by the PDNA guidelines and seems to be a good feature of PDNAs. In real life the strength of cooperation rather turns into a difficulty to carry it out. Interviewee 1 said "it is more a practical issue then a conceptual issue concerning the cooperation during PDNAs". When a disaster strikes in a big country and many provinces are affected a PDNA just does not have the capacity to have a person from each sub-sector in a certain area. It is important to cover all of the affected area so curtailments have to be made. This should not affect the PDNA process but a smooth cooperation between the sub-sectors is not always realistic. How smooth the cooperation works in a PDNA was also asked in the online questionnaire and more than 2/3 of the respondents said that they partially agree or partially disagree that the cooperation between the sub-sectors works smoothly. This shows that the cooperation between the sub-sectors has room for improvement, however you have to consider that less coordination does not automatically means the PDNA is badly done. It allows that things are done twice or data is not shared so some sub-sectors have more problems with getting their data and conducting an extensive report.

An issue, which has to be slide in at that point, is the fact that according to interviewee 6 "nobody has rock solid hard data. The most solid data comes from the percentages of infrastructure destroyed and damaged and even there is a large space of error". So the data, which might be shared among the sub-sectors, is possibly incomplete or incorrect. This incompleteness cannot be changed because it is a time aspect how detailed you are able to collect and raise data. In the
case of a PDNA time is very short. And if the losses and damages are intangible it is even harder
to get presentable data. Interviewee 6 continues by saying, "when we look at losses and the softer
things of how disasters affect our sector it is often best estimates and informed estimates between
groups of experts". One can assume that on the one hand the data in a PDNA is often estimations
by experts. And on the other hand it shows that sub-sectors with more intangible affects tend to
have more problems to come up with figures for damages and losses and therefore the interest
might be less because in the PDNA report these certain sub-sectors seem to be less affected.
Interviewee 1 already suggests, "[..] there could be more emphasis on how non-quantitative
aspects can be cooperated in this [process]". This could also be one reason why the respondents
in the online questionnaire said that not the same attention is given to all sub-sector that is
connected to the numbers and figures they are able to present. As you can see in figure 15 nearly
2/3 think that the attention in a PDNA is not split up the same amount to each sub-sector. Next
to the problem with intangible damages and losses in some sub-sectors the economic
perspective of PDNAs as already mentioned before has a great influence for the respondents to
give an answer like this. Obviously there is an imbalance in PDNAs if not the same amount of
attention is paid to all sub-sectors and a disparity will develop and certain issues will be left
behind. This disparity shows parallels to the dichotomy of the geographical risk approach. On
the one side there is solid data which can be calculated and analysed objectively. This data
seems to be presented in an economic way. On the other side there are aspects that are
intangible and therefore different for every person. Everyone constructs its own views on how
intangible damages could affect the people in the mid and long term recovery process.

The same amount of attention is paid to all sub-sectors during PDNAs.

![Pie chart showing the responses to the statement about equal attention to sub-sectors during PDNAs.]

Figure 15: Amount of attention given to sub-sectors (own figure)

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>I totally agree</td>
<td>34%</td>
</tr>
<tr>
<td>I partially agree</td>
<td>27%</td>
</tr>
<tr>
<td>I partially disagree</td>
<td>9%</td>
</tr>
<tr>
<td>I totally disagree</td>
<td>3%</td>
</tr>
<tr>
<td>Do not know</td>
<td>27%</td>
</tr>
</tbody>
</table>

n=33
Making it even more difficult not only the data or the economic tendency but also the local government can influence the attention given to each sub-sector. As the local government has the maximum influence at a PDNA it is important that on the one hand the interest of the local government covers all the different aspects and issues of a PDNA and on the other hand the local government has the capacity to do so. Interviewee 6 mentioned, "the PDNAs should somehow align with national accounts and national government structures. If you do not have a host government entity in a country you have a problem". This basically means if a local government does not have political institutions responsible for a certain issue then this issue will hardly be taken into account at a PDNA. So even if several agencies recommend certain issues to the local government it might happen that due to the lack of capacity these issues will not be considered. That means it is necessary for the PDNA process to have the local government involved but by doing so you will have limitations in the implementation of the PDNA guidelines. But with this process good risk governance could be developed. As shown in chapter 3.4 risk governance has several stakeholders involved for different fields of investigation like environment or health issues. By executing a PDNA the risk the people are exposed to 'natural disasters' could be reduced with the help of different institutions, agencies and the local government. There are however also limitations. They are connected to the structure, the capacity and the interests of the local government. Structure refers to ministries or institutions, which do or do not already exist in the local government. Capacity is the manpower, which is actually able to carry out a PDNA for the local government as experts. And the local governments interests are initiated by the two previous factors. If there is no governmental structure dealing with environmental issues it will be much harder for the environmental sub-sector to be considered at the extent it should be. And if there are no experts from the government dealing with environment it will be the same dilemma.

It has to be distinguished however between the actual interests of the local government and the lack of capacity. Interviewee 4 said "I think it is important to make a distinction between the priorities of the government in specific countries and the capacity of the government and the international agencies present to support the PDNA". This means that there could not only be a lack of governmental personnel but also a lack of experts from other agencies. He continues to explain it by saying "the government might be very interested in the environmental [sub]-sector but does not have the capacity to the assessment. And UNEP and UNDP simply did not find anybody who is available for the period of time". These limitations could lead to having a certain sub-sector hardly considered which might has a bigger influence in the mid and long time recovery of the country but was not taken into account in the first place due to any of these reasons. There are however PDNA trainings as already mentioned in chapter 4.3.4 and earlier in this chapter where the government can send people to. They get trained how to carry out a PDNA and in the
case of a ‘natural disaster’ they know what to do and what to request from the international disaster management community. Unfortunately people who are sent to PDNA trainings are often from selected ministries or institutions, which mirrors the priorities of the country already. Nonetheless PDNA training is very important especially for the local government because they might have never done a PDNA before. Interviewee 4 raises the importance of PDNA trainings by saying "the quality of the assessment depends on the person carrying it out. Sometimes there are people who have never done a PDNA and not even a training. For what ever reason their agency will sent them to the PDNA. They then read the PDNA guidelines and try to do a PDNA which most of the time does not work very well". This demonstrates that everyone who participates in a PDNA should have been trained before. Additionally people will meet at the trainings around the world and get in contact with experts from the UN or WB already and can exchange experiences and views with people from other countries. These trainings are also one reason why PDNAs work better and better every time with the potential to make PDNA the strongest needs assessment process in disaster management.

The aftermath of a PDNA will be analysed and will be critically questioned now. The process of PDNAs seems pretty clear but what happens after the PDNA can be very blurry but is decisive how a country can perform in the disaster mitigation and preparation phases. After the PDNA process a donor conference will be organised where countries and multilateral organisations can look at the final PDNA report and on the basis of it they pledge money to the affected country. That all sound very well and good however this process has many difficulties. At the donor conference only countries having an interest in the affected country will pledge money. By doing so they have political influence on the other country and political battle for power continues. As interviewee 4 explained that in the case of the Serbian PDNA Austria surely was pledging money at the donor conference because they have political interest in Serbia. In the case of the Nepal PDNA surely India was giving money. It therefore seems that even though the pledging countries seem generous and good-natured they will all give money for a calculable reason. The money from the countries or the multilateral organisations like the World Bank or the IMF (International Monetary Fund) is money generated from development aid. Furthermore the pledging country "will tell the country where they should put the money and some countries give money free" as interviewee 1 said. Therefore certain sub-sectors might get more attention as sub-sectors from the productive sector because most countries have more interests in the reconstruction of the economy then in environmental issues. The countries will not particularly neglect certain sub-sectors but as interviewee 1 continues to say "some countries will not say do not put it into schools but they will say but it into economy which will imply that they have different priorities. It is very possible that some sub-sectors get less attention at this point". Here the debate about the equal inclusion of all sub-sectors gets another aspect of influence.
So one aspect is the politics and interest expressed by the pledging countries and the other aspect is how the money gets to the affected country. Especially interviewee 6 was very concerned about the process after the donor conference. S/he said, "there is no good source were you can easily find how much money the government reallocated to its recovery efforts. And there is also no central database were you can find what the World Bank, the EU, the Germans, the Japanese, who every gave support to a government for recovery, there is no central database where you can quickly find [it]. You often can find how much money was pledged at the donor conference but trekking this to how much money was actually dispersed and how much of that money was implemented often remains very difficult to get a grip on. There is no single source for that kind of information". S/he went even further and explained the funding mechanism in more detail and underlines the problems connected to it. "When the government issue[s] the report and they organise a donor conference there is transparency on how much the World Bank will give, how much the UK will give, how much the EU will give. Those amounts are written down. And the total amount of how much money is being pledged. But then governments are often slow to actually transfer the money to the governments or they do not agree on establishing a good funding mechanism. Often they want to create "poor" funding mechanisms or sometimes they do direct budget support to the government or a mix of it, or sometimes they do bilateral, or sometimes they channel through a UN agency or a third party. So those mechanisms are often not clearly established in a coordinated manner. But also then the actual precise amount of money that are transferred, through whatever channel, we do not know how much money is actually dispersed. Then the third layer is that we do not know how much of that money is actually spent. If a donor pledges 150 million but they actually transfer 100 million. We often do not know how much of that 100 million is spent in the first year or in the second year". This ambiguity of the funding mechanism seems to be a bigger problem because even though the PDNA process and the final PDNA report are properly done it could partially fail due to the aftermath.

Another reason for a problematic funding mechanism is possible corruption in the affected country. Interviewee 6 continues by saying "part of the reason that governments often make the pledges but then hesitate to wire the money is because there are concerns among others about corruption and the implementation capacity of governments. That is an operational challenge for which you need to find solutions among others through alternative funding mechanisms. So instead of giving the money directly to the government if there are strong suspicion of corruption that is when they create multi donor trust funds and that the people putting money in these funds have a stronger say and how this money is being dispersed and through which channels to minimise the risk for corruption". "Where things become more difficult and challenging and unclear is what happens afterwards. The whole field of the funding mechanisms and implementation arrangements
and support to implementation and actually implementing and monitoring implementations of recovery plans, that is still very unclear and not going very well.”

From these extracts one can assume that there should be a greater focus also on the funding mechanism as well as on the actual usage of the money for the implementation of recovery strategies. It is not beneficial for the affected country if all the donors do politics and show their expression of interests at the expense of the affected country. Everyone should hold back his or her own interest and act in favour of a good recovery process in the affected country. That is a big issue because at the process of a PDNA the UN only has an advisory function even though these experts know particularly what aspects and sub-sectors are important for a good disaster recovery. But in the end the pledging countries sometimes act partially mandatory where the money should go to even though they are no explicit experts in the disaster management process. This imbalance in the balance of power needs to be overcome to guarantee the best possible recovery process to the affected country.

Carrying on the aftermath of the PDNA some practical issues should be mentioned. Some interview partners said that it is a problem of PDNAs that there is no tracking of the recovery process. ‘Natural disasters’ have a much longer affect on a country then only destruction of buildings or roads. Some sub-sectors affects are only noticeable in a mid or long term view. Of course it is most important to get the people's lives back to normal but the people's risk awareness should also change especially for mid and long term consequences. Interviewee 3 gave an example: "It is critical because if you have build your house in the floodplain and your house gets destroyed the people will come back to the place and build the house at the same place. They have not gone anywhere because their exposure is the same". This might be due to cultural or religious reasons but in that case it is just a matter of time when those people will lose their houses again. To show the donors the recovery process after the donor conference there should somehow be a reporting by the affected country as interviewee 3 said, "there is no reporting afterwards. That reporting would be good for environment and also all sectors. There could also be a progress report. How much of this has been fulfilled? Just to keep it on the agenda”. This would make a lot of sense so the money could be tracked at country level and the donors could ask for reports and see what happened to their money. Interviewee 5 makes it more clearly by saying "if you get money for a sector you have to spend it within this sector". This would avoid corruption as well as unnecessary waste of money and will keep the local government under observation so you could get the best possible disaster recovery. At the Nepal PDNA in 2015 first attempts were made to report how the money is used. Especially for sub-sectors with mid and long term effects the table for reconstruction and recovery needs was spit up in short, mid and long-term columns were they say how much money is needed. It starts with the short term needs from 2015-2016
followed by the mid term need from 2016-2018 and completed with the long term needs from 2018-2025. By doing so it is more comprehensible what they need the money for and when they are going to use it. In the case of the Nepal PDNA 2015 these figures are beneficial for sub-sectors like environment and as interviewee 4 said "the Nepal PDNA is a good example for a PDNA report".

This chapter came up with several strengths and weaknesses of the PDNA tool. PDNAs are a very comprehensive and collaborative process that includes many different actors. The high amount of actors however could impedingly affect the coordination during a PDNA. It also means it will take more time to get every actor into the country which could cost precious time. Additionally more actors also act more inflexible which could influence the PDNA implementation. To train actors who are not familiar with the procedure of PDNAs yet there are PDNA trainings. Mostly governments send people to those PDNA trainings to better know what to do when a PDNA takes place. Since the UN, WB and EU can only give recommendations, the local government has the absolute power in a PDNA that is an advantage. It might however also affect the consideration of some sub-sectors. If there is hardly any or no governmental capacity for a certain sub-sector it might get left behind. Also even if PDNAs try to be objective it is still very political. Not just by the local government but also by the donors pledging money at the donor conference. The donors will not just give money in their interest but also on the basis of the final PDNA report. If sub-sectors have problems getting data and numbers because their damages are intangible then they get lower recognition. Therefore there should be emphasis on how to capture intangible damages. Next there should also be a focus on the funding mechanism because it would help the tracking of the money and make the whole donor conference more transparent.

5.2.1 Influencing factors for the implementation of PDNAs

This chapter is based on the PDNA matrix showing different influencing factors in PDNAs and their link to the implementation of the sub-sector environment. To exclude obvious reasons, which could influence either the consideration, implementation or relevance of the sub-sector environment, many possibilities were analysed. 25 PDNA reports from 2009-2015 were analysed on the basis of several parameters why some PDNAs consider, partially consider or do not consider the sub-sector environment at all. The range of parameters went from the type of disaster to economic issues and the percentage of country affected. After all aspects were grouped it was analysed whether any conspicuousness was noticeable. If there would have been a striking group then already one reason which influences the consideration of the sub-sector environment could have been identified. In the end no specific feature was noticed. The fact that
all of these influencing factors did not affect the consideration of the sub-sector environment is already a result. No matter how devastating or of what nature the 'natural disaster' was there is no feature which influenced whether the sub-sector environment was considered or not. Neither the relation of damages of the sub-sector environment to the productive sub-sectors (damages and losses stated in the final PDNA report) or productive damages and losses to the countries GDP nor the amount of impacted people were decisive. The transfer of the PDNA report is a point of criticism. As interviewee 3 said: "When they presented the environmental sector at the donor conference they presented it as a cross cutting sector, and not like a stand alone sector like in the report." It shows that the implementation and the extent of some sub-sectors in PDNAs can vary to the PDNA report later. Either some things are left behind or like in this case the declaration of a sub-sector gets changed for the donor conference. This also shows how difficult it is to get specific results out PDNA reports. The expressiveness of the PDNA matrix should not be reduced by that but it should point out some difficulties concerning PDNA reports. For further comprehensiveness the whole matrix can be seen in the annex.

5.3 The role of environment in Post Disaster Needs Assessments

This chapter tries to show the role of environment when doing a PDNA. The importance of environment in post disaster settings was already figured out in chapter 4.3.3 when talking about disaster mitigation and chapter 4.5.1 when the environmental sub-sector is presented. On the basis of the online questionnaire and the expert interviews further aspects will be examined and questioned. There is one main issue regarding the role of environment. This issue is the consideration of environment where several sub-issues like environmental perception, politics, cross-cutting issues, mid and long term aspects and the methodology of the sub-sector environment flow in.

The first point which influences how intense environment is included in PDNA are politics both made by the local government as well as the international donors as mentioned in the previous chapter. The limitation of the local government might just be the capacity, so they have no person to carry out the environmental sub-sector at a PDNA or even more influential if the local government does not have a ministry for environment. Interviewee 6 expressed this problem by saying "if you do not have a host government entity in a country you have a problem". The local government might be keen on including environmental issues but is just not able to do so. Or the local government is just not interested in environment and shows its priorities more on economic issues. Interviewee 1 has the same opinion and says, "it is also possible that the country’s priorities are not in environment and therefore they are not investing in that". These
priorities can already be shown when the local government invites certain ministries for the preparation to a PDNA. Interviewee 6 mentioned, "in some cases we often find when ministries of the governments invite other ministries for the initial training that they forget to invite the ministry of education, health and environment. They do not consider damaged trees or others". It could however also be the other way round as interviewee 2 mentioned that "in the Philippines the government itself immediately put environment as a priority in their post disaster plans because it was such a devastate impact on the coastline". So the decision whether environment is issued in PDNAs highly depends on the local government.

But the local government does not only make this decision due to their capacity or their priorities but also depending on the disaster. If a disaster mainly affected infrastructural issues the country will not see the need to include environmental aspects in their PDNA. Interviewee 1 confirms that by saying "it is rather a disaster thing then a country thing. It is very possible that a disaster was primarily an infrastructure disaster and therefore there are no environmental consequences". This seems very understandable but could also be deceptive because environmental affects often appear in the mid and long term recovery process and are not recognised in the short-term period. This point will also be discussed later in this chapter. The second factor in politics influencing the role of environment is the donors giving money to the affected country. The donors all have interest in certain sub-sectors, which are usually from the productive or infrastructural sectors. If they want the local government to spend the money in certain sub-sectors they will tell where the money should go. This implies that they give other sub-sectors less attention and they have special priorities for some sub-sectors to regenerate quicker. There are hardly any possibilities to overcome these political interests by the local government and the international donors. Only interviewee 1 and 5 came up with suggestions for improvement. Interviewee 5 said that "governmental officials should be trained on environmental assessments" which could change the awareness of the local government towards environment and might change the consideration in PDNAs. There has already been a change in the status of environment according to interviewee 5 and that it is not an option anymore. This enters the idea of interviewee 1 who said "it is a good idea to insist that environment should be one of the sectors because when you do the damages it might not be obvious but they have long time consequences, so that could be an argument to insist". The only problem with that is the fact that the UN system can only work advisory so this will only partially work as interviewee 1 also mentioned. "Things like top-down cannot work in a UN context because the UN is not allowed to work like that". This problem on the local government level could be overcome if the perception of environment would change. The perception of environment has a main influence on how strongly environmental issues will be taken into account at PDNAs.
The next section will show how environment is seen in the international disaster management community and how this differs to the perception of local governments. Interviewee 1 said, "many people actually believe that environment is not that important, and what we should invest more in is physical infrastructure which has been damaged". This problem of a more economic approach in PDNAs has been discussed throughout the whole evaluation and surely also affects how environment is considered. The reason for this problem is not just the local government but also the technical experts who decide whether environment should be a sector or not. "Many times the technical experts are biased to physical infrastructure. It is not the job of PDNAs to create that awareness" is the opinion of interviewee 1 who sees not only a problem in the perception of environment on a governmental level but also on an expert level. Even though interviewee 1 thinks that PDNAs are not the tool to create a certain amount of awareness towards environment it could still work as a role model like the Nepal 2015 PDNAs. Countries will look at previous PDNA reports and see how important the inclusion of the sub-sector environment is and will then implement it as well. It is questionable if only encouraging countries to look at environmental issues is enough to change the perception towards environment. The respondents of the online questionnaire are already aware that environment should be given more attention in future PDNAs and not only environment but also sub-sectors which influence the environmental sub-sector like Agriculture, Livestock, Fisheries & Forestry and Water, Sanitation & Hygiene should get greater attention (see figure 16). This shows that the perception of environment is already there but somehow it cannot be transformed in satisfactory environment awareness. This does not mean that environment is always insufficiently considered and that it is hardly included in PDNAs (more than half of the respondents in the online questionnaire said that there has been an own expert team for the sub-sector environment in all or most cases) but due to the importance of environmental issues it still needs a different standing. Interviewee 2 mentioned that there have already been changes in the recognition of environment then 10 years ago not only "as a driver of risk [but] also as [a] consequence of disasters". Especially this fact makes environmental aspects so important in the disaster recovery process and will be picked up later again when talking about mid and long term affects of environment. Interviewee 3 thinks that the perception towards environment differs depending on who you speak to and the context of the disaster. "Overall there is more and more perception towards environment. It is an emerging topic and the people see it more and more often and environment also comes up in other topics" continued interviewee 3. This also shows the fact that environment is included in so many different sub-sectors and issues during PDNAs that it is advisable to have an own expert team on environment. But this could also be a reason not to have environment included in PDNAs because the local government or the experts think environmental issues are covered enough already by all the other sub-sectors and that it is
Figure 16: Which sub-sector should be given more attention (in green: sub-sector environment and environment related sub-sectors) (own figure)

unnecessary to have an own sub-sector on environment. The point whether to have the sub-sector environment in your PDNA or not might also be the reason for the results in figure 17. It clearly shows that the respondents have nearly a balanced view if the sub-sector environment is sufficiently considered during PDNAs. The reason for that might be the points just raised but also the mix of respondents. If you are involved with environmental issues in PDNAs you might
agree less with this statement then someone who is involved in a productive or infrastructural sub-sector and thinks that environment is considered sufficiently enough. In the case of the online questionnaire people from 14 out of 19 sub-sectors were involved while 33 out of 40 respondents were involved in one or more of these sub-sectors. For this aspect the sample of the online questionnaire is balanced however not representative. This is the same for the country of birth of the respondents. 29 out of 40 answered where they were born and these 29 came from 23 different countries from Europe, Africa, Asia, South-East Asia, Central America and South America. It just shows that there are a great variety of respondents who gave answers in the online questionnaire. A further aspect on the perception of environment in PDNAs comes from mid and long-term effects environmental damages have on disaster recovery. Interviewee 2 said, "it (it refers to PDNAs) does not capture all environmental impacts of disasters, specifically one which are related to long term degradation that will impact on livelihoods and long term recovery". That shows the problems with environmental effects because they are just harder to grab for the experts as well as for the local government and local population. PDNAs surely have the intention to get "the country back to normal" as interviewee 2 continues and this happens in an immediate post disaster setting with a close look on lives and livelihoods. Interviewee 2 knows how difficult it is to equally deal with different aspects in the post disaster setting especially when the affects of the different sub-sectors happen at different times."It is nothing wrong with the first focus on survival and recovery of bodies after a disaster. There may be immediate public health threats as a consequence. Some of the immediate environmental priorities look at health issues. The other thing about impact on recovery and ecosystem services is at a

The sub-sector on Environment is sufficiently considered during PDNAs.

![Figure 17: Consideration of the sub-sector Environment (own figure)](image)

n=33
later stage. In immediate impact after the disaster the focus has to be on people and public health. If there is a chemical leak for example or a factory has been flooded they are looking at the chemical pollution. In that sense you look at immediate environmental emergencies that is logical. You cannot prioritise everything right away”. This statement shows the complexity of sub-sectors like environment when immediate affects can appear but also mid and long term affects can influence disaster recovery. And as you can see in figure 6 an ideal disaster recovery can take up to 60 months. The experts will partially be aware of this problem however the local government and the local people will not bother about environmental issues as long as they are not immediately and directly affecting them. Maybe the people also misunderstand the role of environment. Interviewee 1 gave a relevant example: "So in an environmental context we try to do ecosystem damage which is very different from looking at the ministry of environment which has been damaged. It is difficult for the people to understand intangible things. This is a problem”.

And most environmental damages are intangible and show their effects at a later stage. Interviewee 1 also knows a reason for this dilemma. S/he said "it is always a good idea to make the people aware how important environment is, not only in PDNAs but also in life in general. There is a lack of environmental awareness across the globe". The lack of environmental awareness might be the reason for a limited implementation of environmental issues but is also very difficult to change. In a PDNA however you could recommend to also include environmental aspects even though they seem not relevant at the moment. This knock on effect does not only exist for environment but the biased view of experts and local governments in PDNAs can also be presented by this example from Interview 1. S/he explained that in the sub-sector education they will only look at schools and teacher but they will not consider the effects of every pupil losing one school year. This will have far-reaching impacts on the whole country years later but will hardly be a part of a rapid tool like PDNAs.

Coming back to the problems concerning mid and long term affects. The way of getting data for the sub-sector environment is and will be a great challenge. As many environmental affects are intangible they are also hard to record. In an economically oriented tool like PDNAs only figures in the final report will count in the end. Interviewee 3 supports this aspect by saying: "It is complex in a sense that it is difficult to monetise. It is hard to give figures. For example if it is waste you can calculate that. How high is the cost to sewage the waste and remove and transport it. You can do good evaluation but the time is too short. You can get the figures and calculate, but to do that is difficult. Things like environment are longer term and require more data and are more difficult to calculate. I think it does not get it full rightful place, although there is a good section on narrative. You can describe it. But these PDNAs are made for donor conferences. We try to do proximate here but it is not as rigorous as for our other colleagues who have much more precise
figures". It is interesting that the narrative part of the sub-sector environment seems to be done satisfactory but in the end the donor will only pledge money on the basis of the figures in the finale PDNA report. The difficulty with getting figures in the sub-sector environment is emphasised by interviewee 3 again when s/he said, "you have to proof that there is a loss. If you know a mine was flooded and there is pollution in the river and the fish die you can calculate that. That longer term impacts are very difficult to calculate. What we calculate is more on the clean up and the rehabilitation of the side. That is what we did for several of the mines in Serbia. The longer term impacts are very difficult to get data". But especially the longer-term aspects in environmental recovery are of such a great importance for processes like disaster mitigation (chapter 4.3.3) and disaster preparation (chapter 4.3.4) and to increase the population’s resilience. What makes the difficulty with getting figures even more aggravating is the fact that most figures in the environmental aspect are considered in an economic perspective. More than 2/3 of the respondents from the online questionnaire support that assumption and totally or partially agreed that environmental concerns are mostly considered in an economic perspective as you can see in figure 18. On the one hand only the narrative part of the sub-sector environment will not give it the needed attention and on the other hand to get as much attention as possible intangible things are tried to be shown in figures. The fluctuation and incorrectness of these figures will be even higher then in sub-sectors where you have tangible numbers and figures like destroyed houses or damaged infrastructure.

Environmental concerns in PDNAs are mostly considered in an economic perspective

![Figure 18: The economic perspective of environmental concerns (own figure)](image)

n=33
Another question in the online questionnaire was asked to see the awareness of the respondents concerning sustainable recovery. The role of environment is crucial in sustainable recovery due to the ecosystem services. The answer is shown in figure 19 and clearly points out that a discrepancy exists between the respondents. Next to housing the sub-sector of employment and livelihoods are mentioned most often. So the respondents see the key for a sustainable recovery in the reconstruction of houses and getting the people back to a normal life with work, family

**Figure 19: The contribution of each sub-sector to sustainable recovery (own figure)**
and friends. This is however rather a short-term goal and the basis for a sustainable recovery. But if the focus is mainly on those sub-sectors the country will suffer badly in a mid and long term recovery process because important sub-sectors like environment, disaster risk reduction or education are left behind. Figure 19 of course shows that many respondents are also aware that these sub-sectors are important for a sustainable recovery but it also implies that mid and long term effects get less attention because they seem so far away in the recovery process. In the case of environment many effects might cause further 'natural disaster' in a long-term period like landslides or floods. Especially the ecosystem services should be mentioned here as well as the protective effects of mangroves to coastlines. Also effects from other sub-sectors like Agriculture, Livestock, Fisheries & Forestry and Water, Sanitation & Hygiene flow into the sub-sector environment and have additional mid and long-term effects which should also be considered. Interviewee 2 mentioned a possibility how to overcome this problem with mid and long term effects in the sub-sector environment. This could work by doing a specific rapid environmental assessment like it happened in Nepal 2015. The report came out about 4 month after the earthquakes. According to interviewee 2 this special report "is still relevant for the medium and long term recovery and will help set priorities. That is a good model to follow for me". That shows a learning process concerning environmental aspects in PDNAs and even though an own report on environment will not happen at every single PDNA interviewee 2 suggest to flag in a PDNA if there "is the need for a more comprehensive detailed assessment". This idea could not only work for environment but for all other sub-sectors with mid and long term effects. The last point concerning the role of environment in PDNAs is the stated status of environment in the PDNA guidelines and how this affects environmental concerns. The sub-sector environment is declared as a cross cutting sector. This influences the role of environment in PDNAs already in advance either in a good or bad manner. The idea behind cross-cutting sub-sectors is the interdisciplinarity that makes them cross-cutting among several other sub-sectors from like infrastructure, productive or social. Therefore cross-cutting sectors have to work closely with other sectors to avoid overlapping or repetitions but still have to make sure that they are considered sufficient and adequately. Regarding the sub-sector environment different opinions about the cross-cutting status could be worked out from the online questionnaire and the expert interviews. One question in the online questionnaire aimed to ask the respondents about their view on the importance of the four sectors in PDNAs. As it shows in figure 20 the respondents from the online questionnaire think cross-cutting sub-sectors are least important in PDNAs. This result came out by ranking the sectors from one to four. The weighting was then multiplied by the nominations of the respondents in reverse. Even though the respondents think cross-cutting sub-sectors are least important they said that they should get more attention as shown in figure 16. Three out of four most mentioned sub-sectors that should get more attention are cross-cutting. Maybe the people are not aware which sub-sectors are cross-cutting or they just say
they need more attention but in the end they will still try their best for their own sub-sector so it is a bit hypocrisy. Interviewee 1 also has the opinion that "environment and other cross-cutting sectors come much later and there is clearly a different perception" and interviewee 6 said "most think when being signed as cross-cutting you do not receive the same amount of attention as when you deliver your own stand alone message". Whether this is true or not is hard to say but some experts think the sub-sector environment should better be a stand alone sub-sector. Interviewee 1 and 6 consider that it is more beneficial and it otherwise be merged in other sub-sectors. Interviewee 1 also sees a problem with the idea behind it. "In a theoretical sense it makes sense but in a practical sense it makes no sense. A stand alone sector status would surely be beneficial". Interviewee 3 is undecided whether environment should be cross-cutting or not but the fact that cross-cutting sub-sectors do not get a budget line and if "you do not have your own heading you are kind of missed" shows the ambivalence. Supportive data for environment to be a stand alone sub-sector also comes from the online questionnaire. Nearly 2/3 of the respondents agree or partially agree that environment should be a stand alone sub-sector (see figure 21). This is a clear majority however there are still some people who definitely see environment as a cross-cutting sub-sector. Some of the experts see the benefit of cross-cutting sectors to be at least considered at all as interviewee 2 said "it should still be seen as a cross cutting sector because that is the only way that people will take environment into account". This argument however seems rather weak for the sub-sector environment to stay cross-cutting and it more or less runs it down. Interviewee 4 however sees a strength in cross-cutting sub-sectors. S/he stated: "I think it is a strength. If you take my sector for example Employment, Livelihood and Social protection, is
also a cross-cutting sector. And that is precisely because the analysis of the sector depends to a large extent upon the data of the other sectors. And that is the same for the environmental sector. If you want to know the impacts of the environmental sector you have to understand how many houses have collapsed and is there any major factory which has blown of, is there toxic leaking into the ground. If you do not get that data you do not do your assessment right and that is why it needs to be cross-cutting". This argument implies however that the cooperation between the sub-sectors works smoothly and that the data from the other sub-sectors is good and useable. In chapter 5.2 the cooperation between the sub-sectors was already analysed and it came out that 2/3 of the respondents said that they partially agree or partially disagree that the cooperation between the sub-sectors works smoothly. There was another question in the online questionnaire that aimed to find out if there was specific coordination between environment and other sub-sectors as shown in figure 22. The results show that there usually is cooperation between the sub-sector environment and other sub-sectors. How good, sufficient and expedient this cooperation was still has to be questioned. So if there is cooperation during PDNAs and the cooperation improves and works smoother in the future the cross-cutting status can be beneficial. There could also be a middle course concerning cross-cutting sub-sectors and their consideration. The sub-sector environment can be declared as cross-cutting but if there is the necessity for environment to become a stand alone sub-sector it should be considered as a stand alone sub-sector. Interviewee 2 also sees this possibility and said "the potential for mainstreaming into the key sectors which have already a lot of traction like agriculture is good. It could also be a stand alone. Just because it is labelled as a cross-cutting sector it does not mean that is has to be like that in all PDNAs. There is flexibility to both. There are few PDNAs that have come
up with its own stand alone environment chapter when it was obvious to be a stand alone thing”.

Who should decide whether environment becomes a cross-cutting sub-sector or a stand alone sub-sector is not clear and at what stage of a PDNA this decision will be made is also uncertain. There could also be the possibility to just declare environment as a stand alone sub-sector so it gains another status but it still stays cross-cutting. This idea results from the outcome of a question from the online questionnaire were the impediment of the consideration due to a cross-cutting status was asked. The results can be seen in figure 23. They are rather unclear and uncertain if the cross-cutting declaration actually impedes the consideration of sub-sectors in PDNAs or not. Therefore the idea to make cross-cutting sub-sectors more flexible in their interpretation is very good and seems applicable with some points to sort out. A further problem showing several points mentioned in the whole evaluation already was brought up by interviewee 3. S/he said "when they presented the environmental sector at the donor conference they presented it as a cross-cutting sector, and not like a stand alone sector like in the report". S/he was talking about the Serbian Flood in 2014 where environment was a stand alone sub-sector.

The fact that the status was changed at the donor conference compared to the final PDNA report just shows the aspects of cross-cutting, politics and the environmental role in PDNAs again. Reason for the local government to change the status of environment again is maybe to downgrade it but not to make it less valuable and with that to direct the attention on other sub-sectors which seem more important for the local government. These facts all influence the role of environment in the PDNA process. It goes from simple awareness of environment to politics
made on the expense of environment to the tracking and presentation of environmental damages up to aspects in the methodology of PDNAs.

The main findings concerning the role of environment in PDNAs are diverse. The sub-sector environment might not get considered in PDNA due to the local government (also see chapter 5.2). Not only politics by the local government but also a lack of government entities could be the reason for less consideration. It therefore highly depends on the local government if the sub-sector environment is part in a PDNA. If this is the fact there are still some impediments that influence the appropriate implementation of the sub-sector environment. Like the damages of the sub-sector are most of the time intangible which makes it problematic to get data and numbers for the final report. Mostly the damages are seen in mid and long-term. This also influences the perception of the sub-sector environment by the local population and government. It is also the reason why the numbers and figures for environmental issues are often considered in an economic perspective. Nonetheless it can be assumed that the people executing a PDNA are aware of the importance of environment in sustainable recovery. Another big issue influencing the consideration of the sub-sector environment is its declaration as cross-cutting. On the one hand the cross-cutting status of environment reduces the importance of the sub-sector. On the other hand however the cross-cutting status is the only way how environment is taken into account. There should however also be the possibility for the sub-sector environment to become stand alone if necessary. This would give it more flexibility and
would partially overcome the indicated cross-cutting problem. Further it would change the status of environment at the donor conference. As a stand alone sector environment would stronger be considered.

5.4 Recommendations for environmental concerns in Post Disaster Needs Assessments

This last chapter concludes the role of environment in post disaster settings and shows which recommendations could be made regarding environmental concerns in the PDNA process. The overall picture of how the relevance of environmental issues is seen in PDNAs is good on the paper but bad in real life. This disparity between theoretical and practical implementations has to be overcome to change how environment is seen in post disaster processes next to aspects during the implementation. These points can be divided into three phases to make the overview as simple as possible. It is split up in issues before, during and after the PDNA. Before the PDNA the awareness and the status of environment is most influential. During the PDNA the cooperation between the sub-sector environment and other sub-sectors and the preparation and display of figures is most crucial. In the aftermath of a PDNA the follow up and the tracking of environmental issues should be considered.

The relevance of environmental aspects can already be influenced in advance of a PDNA. Connected to that the topic of awareness is decisive if environment is considered in PDNAs. There are two types of awareness important in the context of PDNAs. The first kind of awareness is the general awareness of how important environmental issues are. This shows the people’s every day awareness on environmental issues. The second kind of awareness is the awareness on the essentiality of environmental issues in the context of disaster recovery, especially in the mid and long term process. Both types of awareness are important in post disaster settings and the people executing a PDNA should be aware that environment has a main influence in disaster recovery. Otherwise the relevance of environment diminishes. The awareness of the common population could be changed with the help of community-based events and institutions. In the end however the affected population does not decide whether environmental aspects are considered in PDNAs. Therefore the awareness of the experts also has to change. This could happen with the help of PDNA trainings as already mentioned in previous chapters. The challenges with the capacity of some governments must somehow be solved. The local government’s priorities should not be decisive which sub-sectors are involved in PDNAs because the government could already preselect certain sub-sectors. Interviewee 5 also thinks "governmental officials should be trained on environmental assessments". Only the awareness of the experts from local governments was mentioned so far but to minimise the
limitations maybe also experts from international agencies like UN and WB should be trained. It is questionable if everyone from those international agencies is aware of the importance of all the (sub-)sectors involved in PDNAs. They are not to blame for that but it might simplify many other aspects, already mentioned before, in the PDNA process. It is further questionable if this works because experts are mostly interested in implementing their sub-sector as good as possible. Maybe some experts do not want to know more about sub-sectors like environment when they are experts in the sub-sector housing. An overall awareness towards all aspects considered in PDNAs by all experts and people executing the PDNA would be desirable.

The second recommendation regarding environmental concerns before a PDNA or just at the beginning is to make the sub-sector environment equal from the start. Interviewee 4 brought up this point and said: "Ideally the environmental sector should also be in the PDNA secretariat and be part of this process of monitoring and overseeing the data collection so from a first day onwards you can mainstream this environmental idea and make a good job, and check if your colleagues are asking the right questions and if they are collecting the right data. Because if you do not do that from the first day onwards the assessment is done and suddenly you realise that you forgot to do my own work and that I did not do a good analysis". This would on the one hand lower the effects of the sub-sector environment being declared as cross-cutting while on the other hand the cooperation could be improved and initiated by experts from the sub-sector environment. This might bring a greater relevance of the topic environment with it and improve the implementation process for the sub-sector. This idea however only works if enough workforce is participating in the PDNA not only for the sub-sector environment but also for all sub-sectors that seem to get less attention.

Linked to this idea there are two aspects that could partially change the relevance of environmental concerns during PDNAs. These aspects both have a practical and theoretical side. Interviewee 1 made a statement which includes many aspects also for the other points in this chapter. S/he said, "it could be better coordination between various actors. There could be more emphasis on how non-quantitative aspects can be cooperated into this. There could also be more awareness of PDNA in the actors, so people will know what they can expect and what they cannot expect in PDNA". The first point s/he mentioned is the coordination between the actors which is crucial to also have a good cooperation. You will not get a good data exchange if you hardly see people from sub-sectors which are influential for your sub-sector. S/he continues and said "the intention to cooperate is very most there. It is more the practical aspect of cooperation which is difficult". To have a good coordination and cooperation is therefore also one key for a more sufficient consideration of cross-cutting sub-sectors because they are depending on a good coordination and cooperation process.
The second thing interviewee 1 said is a greater emphasis on non-quantitative aspects. This problem was already picked up in the previous chapters when intangible damages in mid and long term of the recovery process were mentioned. If it is not possible to quantify damages you will get less attention because in the end the numbers and figures in the final PDNA report will matter. Interviewee 3 also mentioned by "simplifying the tools of how to calculate environmental damage and giving it the time and data constraints to do some estimations that could improve it". Maybe the relevance of the sub-sector environment will rise when having more solid figures at the end of a PDNA. Sub-sectors like environment could then also present oneself more economically and request a more specific amount of money based on solid figures but without any curtailments having to be made. Interviewee 5 said "there are already money matrices for wetland, biodiversity et cetera". This shows that the consideration and the awareness how important environmental aspects are has already changed and that new tools how to solve these problems are developed. There will however still be the problem with mid and long-term effects because it is difficult to precisely predict how much money is needed.

One possibility to increase the relevance of environment is by doing an own rapid assessment on environment like done in Nepal 2015. and link that to PDNAs Especially more comprehensive and broader environmental issues were covered which probably would have not been covered by the PDNA. This surely would be a nearly perfect solution but if the local government is not that keen on recovery of environment there could be another possibility. As interviewee 2 mentioned "if there are massive destructions in habitat or degradation in ecosystems the people should have a checklist to flag it as that there are more extensive studies needed in future". The idea basically is to have the possibility in the PDNA to flag certain issues in all sub-sectors in the final report which should be looked at again in the mid and long term process. Even though this flagging would probably be less considered at the donor conference the country would know which issues has to be considered in the mid and long term recovery process. It is however still questionable if a country which did not prioritise environment in the first place will then spend own money on environment in the mid and long term recovery process. To only flag important issues will probably not be enough unless the donors will take it into account. At this point the donors could do politics in a beneficial way for the sub-sector environment and could "force" the local government to stronger look at environmental issues. If donors explicitly want money to be spend on issues brought up by the sub-sector environment then the focus on mid and long term effects will also change. Additionally "it would be good if there would be a monitoring and what happened to the polluted side and how much was done to clean up" said interviewee 3. By monitoring you could make sure that the money is only spend for the issued reason and you could better influence the recovery process in the mid and long term phase. By reporting how
the recovery process is going on the donors may see how useful their given money is applied. This aspect will only marginally influence how relevant environment is considered in PDNAs but if monitoring environmental issues will show how important the sub-sector environment is in the whole recovery process the next PDNA might change.

Interviewee 3 also sees this possibility and thinks if the process of a PDNA and the recovery process afterwards will be evaluated then other countries could see where problems came up and what worked very well. With that the importance of sub-sectors affecting the mid and long term process could rise and might get more consideration the next time. Figure 24 visualises all the recommendations how the relevance of environmental concerns could improve.
6. Conclusion

The purpose for the research done was to screen and demonstrate disaster management processes with a closer look at one quite young tool called Post Disaster Needs Assessments (PDNA) and to figure out how far environmental issues are considered. Dealing with ‘natural disasters’ tends to get more attention in recent years as the magnitude and impacts of disasters rise. But not only the severity of the ‘natural disaster’ but also human action can potentially even worsen the damages. The awareness of people towards ‘natural disasters’ does not seem to increase and the governments of the affected countries often act very biased when dealing with the effects of ‘natural disasters’. The PDNA tool was developed by UN, WB and EU to overcome those problems and to support local governments with expert knowledge and with a good methodology.

The PDNA is very useful and good implementable for the disaster recovery process. It is used all over the world and is easy to understand by everyone who is participating in PDNAs due to thoughtful worked out guidelines. Also the range of agencies and institutions involved next to the local government make PDNAs so comprehensive. In advance people from governments can also be sent to trainings where the process and actions during PDNAs are demonstrated so not only people from the agencies but also from the local government are better prepared in the case of a ‘natural disaster’. Next the extent of PDNAs is very well deliberated, as there are 18 different sub-sectors involved in a PDNA. Depending on the ‘natural disaster’ and the request by the local government it could be fewer sub-sectors executed. Either because some sub-sectors are unneeded in this certain PDNA or the local government is not aware that these sub-sectors are also important for a successful recovery process. One result of this master thesis is the fact that most of the sub-sectors, which should be given more attention, are declared as cross-cutting in PDNAs. The significance of some sub-sectors declared as cross-cutting in disaster recovery is very high. Either the declaration of the sub-sectors or the low appreciation of governments could be the reason to get less money at the donor conference. Some of these sub-sectors have problems with getting enough and good data and figures in the final PDNA report because many effects will only be seen in mid and long term. Especially intangible effects, which come up in a later stage, are hardly taken into account. This makes PDNAs a rather economic approach because mostly figures and the pledged money are seen and other things are not further considered. And also the donors giving the money have a great influence which sub-sector is supported. There could be a well done PDNA sub-sector report but in the end the donors also have own interests, mostly in productive and infrastructural sub-sectors, and will tell where the money should go. If this is a good system is questionable and could be further researched.
The sub-sector which was exemplary closer examined in this master thesis is the sub-sector environment also declared as cross-cutting. By creating a PDNA matrix based on 25 final PDNA reports from 2009-2015 it was looked for conspicuities why the sub-sector environment was considered in a PDNA or not. The result showed that the reason why the sub-sector environment was considered or not had nothing to do with the type of the disaster, the scope of the disaster, the amount of affected people or economic damages and losses. On the basis of that the online questionnaire and the interview guideline were developed to ask questions that give you the possibility to read between the lines. And it turned out that several aspects could impede the consideration of the sub-sector environment. The two aspects of politics made by the donors and the cross-cutting declaration of the sub-sector environment were already presented. A further aspect, which could influence the consideration of the sub-sector, is the perception of environment at the local government level. If the awareness how important environmental issues are for a good disaster recovery does not exist then the local government will probably not ask for environmental experts. This awareness is important because environmental effects are often intangible and do not show up on a short time period. Effects connected to environment rather appear in the mid and long term recovery process when the affected country or region is supposed to function again. There are some possibilities to overcome these problems. First there should be a stronger recommendation of the sub-sector environment by experts executing the PDNA. Second the cooperation between the sub-sectors should improve so sub-sectors with mostly intangible damages could still get better data and figures for the final report. Third there should be the possibility to flag certain issues in sub-sectors which seem to be too marginal for the final report but still need consideration in future. Ecosystem services are essential for a country to sustainably recover again and fundamental for the local population to subsist. One suggestion was also to evaluate PDNAs in a certain time interval to see what worked well and where is still room for improvement. By doing so other countries would see that sub-sectors effecting the mid and long term recovery process are not less important than the other sub-sectors. Of course it is important to get the country back to normal as soon as possible but PDNAs are designed to sustainably help a country in the long run. The PDNA tool surely furthers the field of disaster management. Though it is quite a young tool it already works quite well.

The advantage is that so many actors are involved who permanently can improve the methodology and the implementation. PDNAs should and cannot be considered as perfect but with the approach and strategy it is executed it could get better and better every time. This could also positively influence the sub-sector environment. Still the consideration of environment can be improved in several aspects. There will not be a simple strategy but this master thesis has
shown some paths. The implementation of these paths, however, sill has to be figured out. Some facts are already very promising for future improvements. This also fits in the current global discourses e.g. on disaster management and ecosystem services or risk management and risk perception explained in the theoretic chapters.
Bibliography


OCHA, (Office for the Coordination of Humanitarian Affairs). 2006. “Disaster Assessment.” UN Disaster Assessment and Coordination (UNDAC).


Annex

Expert interview guideline

General questions:
1. How are you involved with PDNAs?
2. How often are you involved with PDNAs?
3. What was your task at those PDNAs?

PDNA questions:
4. What are the strengths and weaknesses of PDNAs?
5. How could the process of PDNAs be improved?
6. How does the cooperation between the sub-sectors work?
7. To what extent is money influencing the implementation of certain sub-sectors?

Questions about environment:
8. What is the overall perception towards the sub-sector environment in PDNAs?
9. Why are some countries not implementing the sub-sector environment?
10. Is it harming for the sub-sector environment to be declared as cross-cutting?
11. Do you have some suggestions to improve the reputation of environment in common in the countries?
**Codes of evaluation**

Status of environment: - negative
  - positive

Implementation of environment: - general about environmental implementation
  - What works good
  - what works bad
  - reasons not to implement environment
  - reasons to implement environment

Execution of PDNAs: - general about execution
  - what works good/practical strengths
  - what works bad/practical weakness
  - ways to improve

Conceptual strengths/weaknesses

Cross-cutting advantages/disadvantages
<table>
<thead>
<tr>
<th>Location</th>
<th>Type of Disaster</th>
<th>Affected</th>
<th>Deaths</th>
<th>Moderate</th>
<th>Severely</th>
<th>Absolutely</th>
<th>Damaged</th>
<th>Economic Needs</th>
<th>Economic Needs</th>
<th>To what extent is the countries main economic sub-sector concerned as a cross cutting sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>Cyclone</td>
<td>64,655,800 people</td>
<td>10,350,000,000</td>
<td>0.1-1 % of the GDP</td>
<td>0.1-1 % of the GDP</td>
<td>0.1-1 % of the GDP</td>
<td>50-75 %</td>
<td>2.73</td>
<td>576.8</td>
<td>Not considered</td>
</tr>
<tr>
<td>Bhutan</td>
<td>Earthquake</td>
<td>111,600 people</td>
<td>1 death</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>Not considered</td>
</tr>
<tr>
<td>Fiji</td>
<td>Flood</td>
<td>31,000,000 people</td>
<td>13,000,000</td>
<td>0.1-1 % of the GDP</td>
<td>0.1-1 % of the GDP</td>
<td>0.1-1 % of the GDP</td>
<td>50-75 %</td>
<td>58.9</td>
<td>22,105,400</td>
<td>Not considered</td>
</tr>
<tr>
<td>Kenya</td>
<td>Flood</td>
<td>38,000,000 people</td>
<td>76 missing</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>not stated</td>
<td>Not considered</td>
</tr>
<tr>
<td>Moldova</td>
<td>Earthquake</td>
<td>3,700,000 people</td>
<td>1.34 %</td>
<td>0.069</td>
<td>0.069</td>
<td>0.069</td>
<td>1.087</td>
<td>0.069</td>
<td>4.81</td>
<td>Not considered</td>
</tr>
<tr>
<td>Nepal</td>
<td>Tsunami</td>
<td>25,700,000 people</td>
<td>57,931</td>
<td>1.21</td>
<td>1.21</td>
<td>1.21</td>
<td>1.21</td>
<td>1.21</td>
<td>1.21</td>
<td>Not considered</td>
</tr>
<tr>
<td>Philippines</td>
<td>Typhoon</td>
<td>100,000,000 people</td>
<td>8,000,000,000</td>
<td>1.485</td>
<td>1.485</td>
<td>1.485</td>
<td>1.485</td>
<td>1.485</td>
<td>1.485</td>
<td>Not considered</td>
</tr>
<tr>
<td>Tanzania</td>
<td>Flood</td>
<td>13,000,000 people</td>
<td>10,056,000,000</td>
<td>2.73</td>
<td>2.73</td>
<td>2.73</td>
<td>2.73</td>
<td>2.73</td>
<td>2.73</td>
<td>Not considered</td>
</tr>
<tr>
<td>Uganda</td>
<td>Earthquake</td>
<td>1,060,000 people</td>
<td>115,000,000</td>
<td>0.069</td>
<td>0.069</td>
<td>0.069</td>
<td>0.069</td>
<td>0.069</td>
<td>0.069</td>
<td>Not considered</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Flood</td>
<td>111,600,000 people</td>
<td>5,217,000 to 10,350,000,000</td>
<td>0.1-1 % of the GDP</td>
<td>0.1-1 % of the GDP</td>
<td>0.1-1 % of the GDP</td>
<td>50-75 %</td>
<td>5.5</td>
<td>576.8</td>
<td>Not considered</td>
</tr>
</tbody>
</table>

**Notes:**
- Orange: 0.1-1 %
- Yellow: 0-0.1 %
- Red: 1-5 %
- Purple: 5+ %
- Purple: 5+ %
- Purple: 5+ %
- Purple: 5+ %
- Purple: 5+ %
- Purple: 5+ %
Online questionnaire

My Name is Kilian Hinzpeter and I am a Master Student in Geography at the University of Innsbruck. My research mainly focuses on risk reduction and man-environment-relationship.

This questionnaire is about Post Disaster Needs Assessments (PDNA) and in particular about the sub-sector of environment. The aim is to find out on the perception of environment and its importance in PDNAs.

Filling the questionnaire will take about 6-8 minutes. The data will be treated strictly confidential and exclusively. The results will contribute to my Master Thesis. The whole questionnaire consists of 17 questions.

If you are interested in the results please do not hesitate to contact me.

Thank you for your collaboration
**General questions:**

The next questions are general questions about PDNA you have undertaken/participated in.

1. Have you participated in undertaking a PDNA?
   - [ ] Yes
   - [ ] No

2. If yes, how many PDNAs have you undertaken/participated in?

3. Have you participated in any of these PDNAs? *Multiple answers possible.*
   - [ ] Bhutan 2009 (Earthquake)
   - [ ] Cambodia 2009 (Cyclone)
   - [ ] Indonesia 2009 (Earthquake)
   - [ ] Laos 2009 (Cyclone)
   - [ ] Namibia 2009 (Flood)
   - [ ] Samoa 2009 (Tsunami)
   - [ ] El Salvador 2010 (Tropical Storm)
   - [ ] Haiti 2010 (Earthquake)
   - [ ] Moldova 2010 (Flood)
   - [ ] Pakistan 2010 (Flood)
   - [ ] Kenya 2011 (Drought)
   - [ ] Laos 2011 (Typhoon)
   - [ ] Lesotho 2011 (Flood)
   - [ ] Pakistan 2011 (Flood)
   - [ ] Thailand 2011 (Flood)
   - [ ] Malawi 2012 (Flood)
   - [ ] Samoa 2012 (Cyclone)
   - [ ] Uganda 2012 (Drought)
   - [ ] Fiji 2013 (Cyclone)
   - [ ] Nigeria 2013 (Flood)
   - [ ] Seychelles 2013 (Flood)
   - [ ] Solomon 2014 (Flood)
   - [ ] Serbia 2014 (Flood)
   - [ ] Nepal 2015 (Earthquake)
   - [ ] No, I have not been participating in any of these PDNAs.

4. Which sub-sector(s) within a PDNA process have you contributed to? *Multiple answers possible.*
   - [ ] Housing & Settlement
   - [ ] Education
   - [ ] Health
   - [ ] Culture
   - [ ] Nutrition
   - [ ] Agriculture, Livestock, Fisheries & Forestry
   - [ ] Industry, Commerce & Trade
   - [ ] Tourism
   - [ ] Water, Sanitation & Hygiene (WASH)
   - [ ] Community Infrastructure
   - [ ] Energy & Electricity
   - [ ] Transport & Telecommunication
   - [ ] Disaster Risk Reduction (DRR)
   - [ ] Governance
   - [ ] Environment
   - [ ] Employment & Livelihood
   - [ ] Gender

Other (please specify)

5. Have you attended a PDNA training before?
   - [ ] Yes
   - [ ] No
6. What was your specific task in the PDNA(s) that you have undertaken?
General questions about PDNA(s)

The next questions will ask about your personal opinion.

7. In your opinion: Please rank these sectors of PDNA in order of their importance, in relation to each other. 
You can rank them by moving the sector boxes up-or downwards from 1 very important - 4 least important.

- Social sector
- Productive sector
- Infrastructure sector
- Cross-cutting sector

8. In your opinion, which sub-sector(s) should be given more attention in future PDNAs? Multiple answers possible.

- Housing & Settlement
- Education
- Health
- Culture
- Nutrition
- Agriculture, Livestock, Fisheries & Forestry
- Industry, Commerce & Trade
- Tourism
- Water, Sanitation & Hygiene (WASH)
- Community Infrastructure
- Energy & Electricity
- Transport & Telecommunication
- Disaster Risk Reduction (DRR)
- Governance
- Environment
- Employment & Livelihood
- Gender
- All sub-sectors are given enough attention

9. In your opinion: Which sub-sectors mainly contribute to sustainable recovery in a country after a disaster? Multiple answers possible.

- Housing & Settlement
- Education
- Health
- Culture
- Nutrition
- Agriculture, Livestock, Fisheries & Forestry
- Industry, Commerce & Trade
- Tourism
- Water, Sanitation & Hygiene (WASH)
- Community Infrastructure
- Energy & Electricity
- Transport & Telecommunication
- Disaster Risk Reduction (DRR)
- Governance
- Environment
- Employment & Livelihood
- Gender
- All sub-sectors contribute the same
Specific questions about your PDNA(s)

10. Please state the extent of occurrence at your PDNA(s)

<table>
<thead>
<tr>
<th>Did you encounter or document environmental damage or loss in the PDNA(s) you have undertaken?</th>
<th>In all cases</th>
<th>In most cases</th>
<th>In few cases</th>
<th>Never</th>
<th>Do not know</th>
</tr>
</thead>
<tbody>
<tr>
<td>Was there cooperation between the teams/groups working on the environmental sub-sector and other sub-sector/s in the PDNA(s) you have undertaken?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Was there a dedicated expert/team for the sub-sector on Environment in the PDNA(s) you have undertaken?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

11. Which sub-sector/s was/were most impacted by the disaster(s), in the country where you have undertaken a PDNA(s)? *Multiple answers possible.*

- Housing & Settlement
- Industry, Commerce & Trade
- Disaster Risk Reduction (DRR)
- Education
- Tourism
- Governance
- Health
- Water, Sanitation & Hygiene (WASH)
- Environment
- Culture
- Community infrastructure
- Employment & Livelihood
- Nutrition
- Energy & Electricity
- Gender
- Agriculture, Livestock, Fisheries & Forestry
- Transport & Telecommunication
- All sub-sectors were impacted the same

12. Please suggest how PDNAs can be improved in the future?
**Statements about PDNAs**

The following will be some statements about PDNAs.

13. Please state to what extent do you agree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>I totally agree</th>
<th>I partially agree</th>
<th>I partially disagree</th>
<th>I totally disagree</th>
<th>Do not know</th>
</tr>
</thead>
<tbody>
<tr>
<td>The overall coordination during PDNAs is adequate.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The cooperation during PDNAs between the PDNA sub-sectors works smoothly.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The sub-sector on Environment is sufficiently considered during PDNAs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The task of assessing disaster damage and loss in each sub-sector is clear.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The PDNA Guidelines for the sub-sector(s) I engage in are easy to understand.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The PDNA Guideline goals/aims of the sub-sector(s) I engage in are easy to implement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
14. Please state to what extent you agree with the following statements.

<table>
<thead>
<tr>
<th>Statement</th>
<th>I totally agree</th>
<th>I partially agree</th>
<th>I partially disagree</th>
<th>I totally disagree</th>
<th>Do not know</th>
</tr>
</thead>
<tbody>
<tr>
<td>The same amount of attention is paid to all sub-sectors during PONAs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The cross-cutting status of environment as a sub-sector impedes its consideration in PONAs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The length of a sub-sector chapter in a PONA report represents the local government's priorities during PONAs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environment should be a stand-alone sub-sector.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental concerns in PONAs are mostly considered in an economic perspective</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. What is your gender?</td>
<td>Female,Male,Other</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. What is your country of birth?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. What is your professional background/field of expertise?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>