



# Finding factors that influence knowledge adoption in post-disaster reconstruction.

## Household Surveys

Gijs van Duren | Thesis | 17-10-2018

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## Preface

This thesis *'Finding factors that influence knowledge adoption in post-disaster reconstruction'* is the last assessment for my bachelor study building engineering at Avans University of Applied science in 's Hertogenbosch. During this bachelor i have learned a lot about the build environment, by meanings of lectures, internships and a minor.

When i started my bachelor i always said i wanted to go abroad for my studies, then I met Eefje Hendriks during my Minor. Eefje Hendriks is a PhD candidate at Eindhoven University of Technologie researching knowledge exchange after a natural disaster. She told me that i good go abroad doing research for my graduation, and I could be a part of her research. Some fellow students also wanted to join Eefje Hendriks for their graduation. After we went to some conferences we decided to go to Nepal to do research about he recovery after the 2015 earthquake. During this research a NGO called Christian Relief Service Nepal (CRS-Nepal) helped us organising everything in Nepal and we helped them by sharing our conclusions from the research.

I would like to thank Eefje Hendriks, Laura Howlett, Sandra van Ekeren, Ranon Caris, Benjamin Schep and Jim de Kort, that were part of the research team, for a unforgettable and instructive time. I also would like to thank all CRS Nepal for or their help in Nepal and my supervisors Michiel Smits and Joost Everts for their feedback and input of this thesis.

Gijs van Duren, Ravenstein, 17-10-2018



Figure 1 The research team during a national holiday in Nepal

## Abstract

Nepal was hit by an earthquake of 7.9-magnitude on the 25<sup>th</sup> of April 2015 (Ter Voorde, 2015). More than 7500 people lost their lives, around 16.000 people were injured, 285.000 houses were destroyed and another 234.000 were damaged (OCHA, 2015). The epicentre of the earthquake was very near to Gorkha district where the impact was huge. The earthquake could be felt until Okhaldhunga district, the impact of the earthquake brought less damage but still enough that houses were destroyed (HRRP, 2016).

Earlier research has shown that people often do not adopt knowledge provided by NGOs the government or another institution (The World Bank, 2016). By finding the factors that influence the adoption of knowledge, the way knowledge is provided can be improved. By improving the way knowledge is provided people could be enabled to build back hazard resistant houses.

This research focuses on measuring the factors that influence the adoption of knowledge in post-disaster reconstruction in Nepal using a household survey. The questionnaire research is based on the MAO model, model for motivation, ability and opportunity (Stokmans, 2005). This report contains the establishment of the questionnaire, the measurement of MAO and the results from the research. The barriers and drivers are found by measuring the level of motivation, ability and opportunity. The results give barriers and drivers for the adoption of knowledge.

This research has taken place in two districts, Gorkha and Okhaldhunga. The districts Gorkha and Okhaldhunga were selected out of the 14 affected districts. Gorkha district has received a lot of technical assistance and Okhaldhunga has received little to no technical assistance. One of the goals of this research is to find the differences between the two districts, when it comes to building back earthquake resistant housing.

In total were conducted 1457 surveys, divided over 26 communities. From the 26 communities, 8 are located in Gorkha district and 16 in Okhaldhunga district. The participants were selected based on a few criteria namely, their age, gender, involvement of the reconstruction, if their house was damaged or not.

During the survey the participants get around 50 questions divided into different categories namely; Financial resources, reconstruction speed, knowledge needs, future plans, applied construction principles, received assistance and trust related questions. All questions in the survey give a better understanding about the level of motivation, ability or opportunity, as well as their trust in materials or people or conducted information for the other research parts.

## Main findings

- Overall the ability to name and replicate earthquake resistant construction principles has been found to be high.
- The adoption of knowledge has found to be high since techniques are applied to construct earthquake resistant (88.9%).
- The percentage of received training is almost the same in Gorkha (60.6%) and Okhaldhunga (54.9%). However, more efforts have been invested in Gorkha. It appears that little technical assistance leads to better results than a lot of technical assistance.
- Technical assistance typologies did increase the level of understanding of earthquake resistant construction principles. The level of understanding in Gorkha is higher than Okhaldhunga.
- Financial support is the most important motivator and barrier for the application of hazard-resistant construction principles. The government tranche (69.8%) is the biggest source of money for the construction of housing followed by taking a loan (52.4%) and own savings (36.1%). Limited financial resources (52.2%) often results in less construction quality. It is expected that when government funding is not provided, people will save on the quality of their construction.
- More than half the people (57.9%) consider themselves as experienced on earthquake resistant constructions, which indicates a high self-efficacy.
- Radio (25.4%), door-to-door (27.0%) and engineers advice (27.0%) are the most reliable sources of information, and the best way to receive the information is also by radio (28.0%), door-to-door (face to face) (61.1%) and via demonstration house (22.2%).
- People are satisfied with the knowledge and experience of the trainer (94.5%). The provided information was mainly about how to build a safe house (59.4%), how to design earthquake resistant (53.0%) , what is a safe location for you house (41.4%) and what are the right materials (47.5%).
- In Okhaldhunga district lots of houses are only at foundation level, this is mainly because people waited with their reconstruction until they received some advice and the governmental tranche. This indicates they are very motivated to receive advice and adopt the provided knowledge.
- Because of the tranche procedure, the reconstruction depends on the knowledge of temporary assigned engineers. They have found to be the main knowledge source. People trust in the provided knowledge (77.5%) because the sender was a trained person or knows how to build a house. This trust and dependency might harm application in the future and is a disadvantage for community resilience.
- Communication of hazard-resistant construction principles are mainly aimed for replication only and did not allow differentiation.



- Technical assistance typologies appeared to be of negative influence on the directly earthquake resistance of housing. Independent application of hazard-resistant construction principles is higher even when limited technical assistance has been given (93.9% against 82.2%). This might be related to the fact that when people are provided with more information and show to have more doubts.
- The main delay in the construction process is because of a lack of money (56.1%), no materials available (40.4%) and limited availability of masons (36.9%).
- A downside of the tranche process is that it slows down the reconstruction because of the bureaucratic, complex and opaque tranche application process. Also some groups are left behind. People waited for governmental tranche before they started with the reconstruction of their house.
- A lot of people have a low opportunity for a safe location of their house, 47.8% did not have other options for the location.
- The level of understanding is insufficient to create alternative designs. As the satisfaction about the government recommended designs is currently low, the low level of understanding might lead to more unsafe structures. Low level of understanding by community based construction professionals, limited to replication of designs recommended by the government, is expected to cause problems in the future when alternative designs are asked for.

## **Recommendations**

It is recommended to provide people with the same knowledge at all time. People show to have more doubts about information when they receive different kinds of information. This is mainly meant for NGOs INGOs and the government. Another recommendation for them is to motivate people with money or materials, to increase their ability to build back safer. The governmental tranche has shown that is motivates people to apply earthquake resistant techniques. However the design people have to apply for the governmental tranche can have some improvements as well. Namely, the flexibility of the design. The current design does often not fit the families needs, but people are not allowed to make changes to design. So it is recommended to make a design with guidelines instead of a strict design people have to use.

For a follow-up study is recommended to make triangulations of the results with the focus group discussion and the structural assessment. It is also recommended to measure the level of motivation, ability, opportunity and trust with the described measurement scale. After the measurement has been made it is possible to identify groups based on motivation, ability, opportunity and trust, and make a strategy that would be appropriate to support the different groups to build back hazard resistant.

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## Abbreviations

BBS	Build Back Safer
CRS	Catholic Relief services
FGD	Focus Group Discussion
HRRP	Housing reconstruction and recovery platform
INGO	International non-governmental organisation
MAO	Motivation, ability and opportunity
NGO	Non-governmental organisation
SPSS	Statistical Package for the Social Sciences
SNA	Social Network Analysis
VDC	Village development committee

## Introduction

After a natural disaster, mostly large populations are affected. In the last 20 years, millions of people died because of a natural disaster and over one billion people are affected by it (Watson, Gayer, & Connolly, 2007). This research has taken place in Nepal. Nepal has been hit by an earthquake in 2015 where more than 7500 people lost their lives and more than 16,000 people were injured (OCHA, 2015). From 1975 until 2003 the amount of reported natural disasters already increased by approximately 500% (Guha-Sapir, Hargitt, & Hoyois, 2004). Predicted is that the amount of natural disaster will even increase more and the situation will be more severe in the next decades (Guha-Sapir et al., 2004). What might be expected by the general audience is that, most of the affected people receive help after a natural disaster, but in reality less than 15% of the affected population receives some technical shelter assistance in the reconstruction after a natural disaster from humanitarian or governmental organisations, on a global scale (Parrack, Flinn, & Passey, 2014). In this study we call this aided self-recovery. The other 85% of the affected populations has to rebuild on their own (self-recovery) (Parrack et al., 2014).

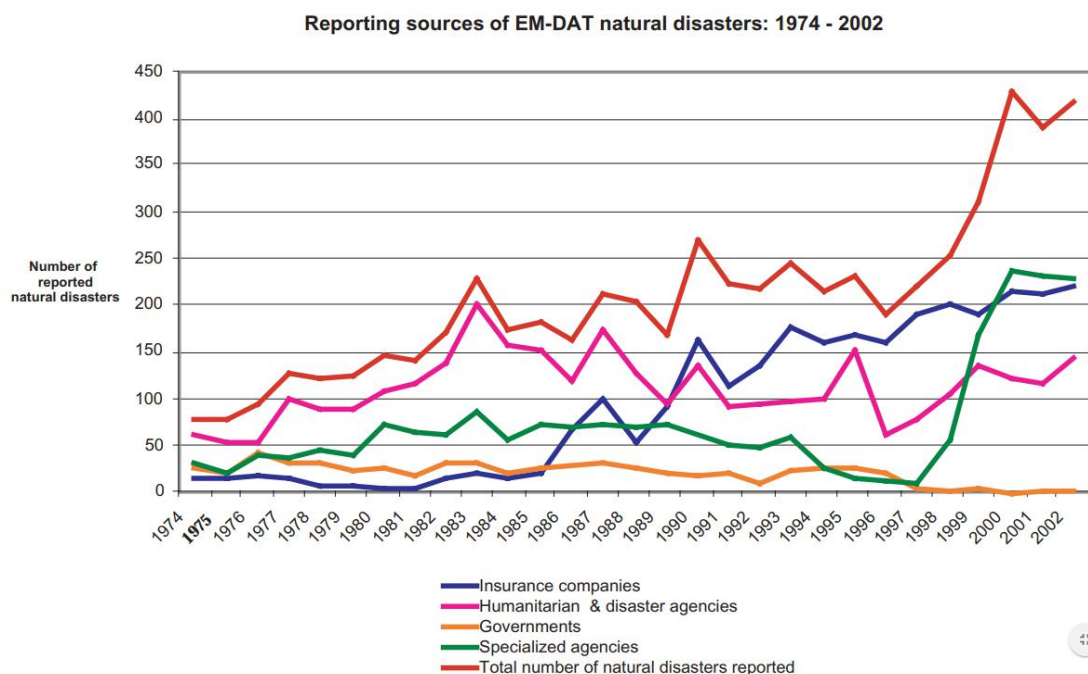


Figure 2: Number of reported natural disasters (Guha-Sapir et al., 2004)

Despite more and more natural disasters occur, people often do not build back safer houses (Kennedy, Ashmore, Babister, & Kelman, 2008). After a natural disaster, houses are often rebuilt without or with very little hazard resistant construction

principles. Especially in areas where natural disasters occur repeatedly, and the area mainly consists of low-income communities (Twigg, 2004).

There is little known about why people do not build back safer, while this is in fact important for their resilience. It is useless to provide technical assistance while people in fact want to receive materials. It is unclear what drives people to build back hazard-resistant. By understanding how the communities want to be provided with knowledge or help, it is possible to increase the adoption of knowledge so the communities understand better how to build back safer. The aim of this research is to gather knowledge about the factors that influence the adoption of knowledge.

Earlier research findings show that, adoption of knowledge is still hindered (Paton & Johnston, 2001). Earlier research also shows that, it is important to know what barriers people face, especially the 85% who reconstruct on their own, and what motivates people to build back a safer house (Kabra & Ramesh, 2015). The overall research is conducted together with TU Eindhoven and CRS Nepal, and addresses this challenge using multiple research methods. In this thesis, only the used household survey is discussed. The advantage of a household survey is that a lot of data can be gathered in a short amount of time.

Based on the literature study and the results from the research of Eefje Hendriks in the Philippines in 2017, is expected that Motivation, Ability, Opportunity (M. Stokmans, 2005) and trust contribute to the amount of adopted knowledge. According to Hoyer and MacInnis (as cited in Gruen, Osmonbekov, & Czaplewski 2005) *“communication effectiveness can be proactively achieved by enhancing individuals’ levels of the MOA elements”*. The main focus of this research is finding factors that influence the adoption of knowledge, through studying the barriers and drivers based on the MAO-model and trust. The MAO-model is a theoretical framework used to measure different levels of motivation, ability and opportunity in the social sciences. This model is chosen because it has never been used before in research to knowledge exchange in housing recovery and could work out very well. The questionnaire of the survey is based on the MAO framework together with trust.

## Research location.

This research has taken place in two district in Nepal, namely Gorkha (8 wards) and Okhaldhunga (18 wards). Gorkha was very near to the epicentrum of the earthquake, as visible in the picture below. These two districts are chosen to see the differences between communities who received assistance and those who did not.



*Figure 3 Epicentrum earthquake Nepal 2015 with the research districts*

Because Gorkha was very near to the epicentrum a lot assistance have been given there. More than 25 NGOs were involved during the reconstruction after the earthquake. Because of the amount of NGOs lots of different strategies on how to provide information has been tried out. The goal in Gorkha is to measure the barriers they face and the level of motivation, ability and opportunity to adopt the knowledge.

The second district is Okhaldhunga. Okhaldhunga is located a bit further from the epicentrum but still affected (OSOCC, 2015). The difference with Gorkha is that Okhaldhunga received little to know assistance. In Okhaldhunga only 4 NGOs were involved, but there has been a higher compliance. This research focuses on the wards that have received no assistance. The goal in Okhaldhunga is to measure the barriers they face and the level of motivation, ability and opportunity to adopt the knowledge. By measuring the same aspects in both districts it is possible to compare the outcomes, and see the differences and similarities.

## Research team

The research is conducted with a research team. This team is formed with:

- Eefje Hendriks (PhD candidate, Eindhoven University of technology)
- Laura Howlett (independent researcher, Oxford, England)

- Benjamin Schep (master student, university of technology Eindhoven)
- Sandra van Ekeren (bachelor student, university of applied sciences Avans)
- Jim de Kort (bachelor student, university of applied sciences Avans)
- Ranon Caris (bachelor student, university of applied sciences Avans)
- Gijs van Duren (bachelor student, university of applied sciences Avans)

Every researcher is responsible for their own research method, but everyone helped each other if necessary. The research methods that are used are household surveys, structural assessments, focus group discussions, general ward analysis, a case study and a social network analysis in combination with key-stakeholder interviews. **This thesis shows the different steps taken to develop the questionnaire, the results from the survey and recommendations to increase the likeliness of adoption taken place.** This thesis is written in collaboration with every member of the research team.



*Figure 4: Interpreter holding a survey with a participant.*



# 1. Research Goals

This chapter contains several aspects such as the objectives, the research questions and the hypothesis. The hypothesis are based on literature study and several expert interviews.

## 1.1 Objectives

The objectives of this research are:

1. To adapt the theoretical model of MAO to identify barriers and drivers in the adoption of knowledge in post-disaster reconstruction.
2. To develop a good survey to find the barriers and drivers, by incorporating all important aspects required for a questionnaire.
3. To develop a practical research questionnaire to be used in the field in Nepal.
4. To identify the barriers and drivers to the adoption of knowledge based on the results from the survey.
5. To identify the levels of motivation, ability, opportunity and trust based on the found barriers and drivers in RQ4 to make recommendations to improve the likeliness of adoption.

## 1.2 Research Questions

The main research question is:

**What is the likeliness of adoption taking place based on motivation, ability and opportunity in processes of self-recovery and aided self-recovery and how can the likeliness be increased?**

Sub questions:

### RQ1

In what way can the barriers and motivators be measured in Gorkha and Okhaldhunga district in self-recovery and aided self-recovery communities via household surveys using the **MAO-model** and **trust**?

### RQ2

In what way can **the level of motivation ability, opportunity and trust** be **measured** by means of a questionnaire and identify group and strategies?

### RQ3

In what way can the questionnaire be adapted to the practical limitations in Nepal and ensure reliable results?

#### RQ4

What are the **main characteristics of the adoption process of hazard-resistant construction principles** found by analysing different districts, communities, and genders in Nepal?

#### RQ5

What is the **expected level of motivation, ability, opportunity and trust** for different districts, communities based on the found characteristics?

### 1.3 Hypothesis

Based on the literature study and meetings with the CRS team in Nepal, Eefje Hendriks and Jan Willem Wegdam the expectations are that:

- Based on the literature study and the results from the data out of the Philippines is expected that Motivation, Ability and Opportunity (M. Stokmans, 2005) and trust determine the extent of the adoption within the reconstruction.
- Motivation, ability and opportunity can be drivers or barriers within the extent of the recovery process. Using the MAO-model the level of adoption of each aspect can be high or low and is an indicator for adoption taking place
- The research will concentrate on two areas, Gorkha and Okhaldhunga. The wards in Gorkha have received more technical support than the wards in Okhaldhunga. It is expected that the ability to construct earthquake resistant is higher in Gorkha.
- It is expected that the level of ability between communities is different. The more remote the community is the less the ability of good materials is. This is expected because the roads provide poor access to these villages for freight traffic (Nepal government, 2016).



*Figure 5: Participant with her new house.*

## 2. Research methodology

### 2.1 Choice of questionnaire

Data for this research is collected using a household survey. A household survey, is a question and answer conversation between the participant and the interpreter based on the principles as described in Shelter and Wash response monitoring (Shelter Cluster & Wash Cluster, 2014). This research is a mixed method research, as well qualitative data as quantitative data will be gathered. This means that both research methods are processed in the questionnaire. This method provides data from different perspectives which is very useful for exploratory research since the method explores as many issues as possible within the time of this research (Hennink, Hutter, & Bailey, 2011). The questionnaire contains questions regarding figures and quantities, but also questions such as 'how' and 'why'. Most of the questions are multiple-option questions, which usually means that it is quantitative data, but that is not the case in this research. some questions people have to answer multiple reasons to do something, or multiple options they want to change for example, this is qualitative data. This is why this research gathers qualitative and quantitative data.

This research method is chosen because it is possible to gather a lot of data in a short amount of time. The language barrier is fairly easy to solve with this method, because interpreters can directly fill in the answers in English, so nothing have to be translated. Because only one questionnaire is used, several teams can simultaneously do field research to collect data. Because all questions are the same it is possible to compare the answers with each other in an easy way using SPSS (statistical package for the social sciences). The household survey is an accepted research method for field research and is easy to compare with other research methods, used by the research team.

The survey will be held to get a better understanding of the recovery process and to find the factors that influence the adoption of knowledge. The survey will exist of many different questions, who all are connected to the reconstruction process. Different topics are added to the survey: time, money, resources, future, construction principles and received assistance, all of these topics will increase the understanding of the adoption process.

## 2.2 Research methods per research question

This study combines different methods to answer the research questions. The combination of methods ensures the reliability of outcomes.

**RQ1.** For this research question an in depth literature study is done. The literature is selected through searching on the keywords; “MAO-model”, “OMA-model”, “MOA-model”, “AMO-model”. Only academic articles are included in this overview. The articles are scanned and read in depth only when they give insight into the definitions of the different aspects and the interpretation of the model to a specific context. The MAO-model has been used in different situations in a variety of social studies and often aims to enlarge adoption in a business context. The literature is therefore interpreted together with Eefje Hendriks that has spoken to a referenced academic expert Mia Stokmans from the University of Tilburg. The has been selected based on her clear writing style, the proximity to Avans Hogeschool, her availability, her willingness to think along.

**RQ2.** The found literature for RQ1 about the MAO-model is scanned on the specific recommendations articles have given to measure and compare the different outcomes and come to a recommended strategy. The measurement methods are analysed based on their applicability for the data collected through the questionnaire in Nepal. The interpretation is made together with ir. Eefje Hendriks and in discussion with ir. Benjamin Schep.

**RQ3.** The questionnaire is developed following a few steps that ensure that the questionnaire is embedded in the cultural situation of Nepal. A similar questionnaire that has been used by Eefje Hendriks has been used as a basis. The definition of motivation, ability and opportunity as defined in Research question 1 has been used to sharpen the focus of the questionnaire and eliminate less valuable questions and adapt questions to what is needed. The full questionnaire is discussed with a number of experts from CRS; Adeel Javaid and Krishna Mohan. The questionnaire has been discussed in depth with humanitarian expert ir Laura Howlett, researcher ir Eefje Hendriks, master student ir Benjamin Schep and an expert in developing questionnaires Mark Mazurel. This has ensured a useful questionnaire. The questionnaire has been tested in a pilot in Gorkha with the interpreters. Based on the pilot changes have been made to ensure that the interpreters understand the question and are able to translate and answer the question in the field. In the second district, some questions have been changed because of misunderstandings of the question. In some cases, additional answer options could have been added.

**RQ4.** The data is analysed using SPSS and taking out all the frequencies for the different districts, communities and genders. The most interesting outcomes are highlighted based on the fact that they are unexpected, or show large differences or

strong show similarities. These outcomes are summarized and give overall characteristics of the knowledge adoption process.

**RQ5.** Based on the definitions of motivation, ability and opportunity the outcomes of the different questions are organised under these aspects and give a first overview of the measurable levels. A deeper analysis could be done with the measurement strategy defined in RQ2. However, this deeper analysis is not part of this research thesis due to time constraints.

### 2.3 Community selection

With the goal of targeting communities who have received different kinds of technical assistance and communities who received limited to no technical assistance. The districts Gorkha and Okhaldhunga were selected out of the 14 affected districts. Gorkha district has received the most assistance and Okhaldhunga the least. These two districts are chosen to see the differences between communities who received assistance and those who did not. Gorkha district is interesting because it is possible to see if the provided assistance and training did increase the amount of adopted knowledge. It is interesting to do research in Okhaldhunga to find out what the most important factors are for people to increase the adoption of knowledge. It is expected that essentials in reconstruction can be best identified in communities that have received little to no technical assistance. Therefore, a larger number of VDC's and wards has been selected in Okhaldhunga. The wards are selected based on; the types of technical assistance received, the damage grade, the completion rate, and the construction rate. Wards were selected that according to the database of the Housing Recovery and Reconstruction Platform (HRRP) have a significantly different profile, based on the criteria above. In Okhaldhunga district in some VDC's 2 wards are selected that have a high damage grade and have received very limited to no assistance and one of the wards in the VDC is quite inaccessible compared with the other, the outcomes are expected to be significantly different between those wards.

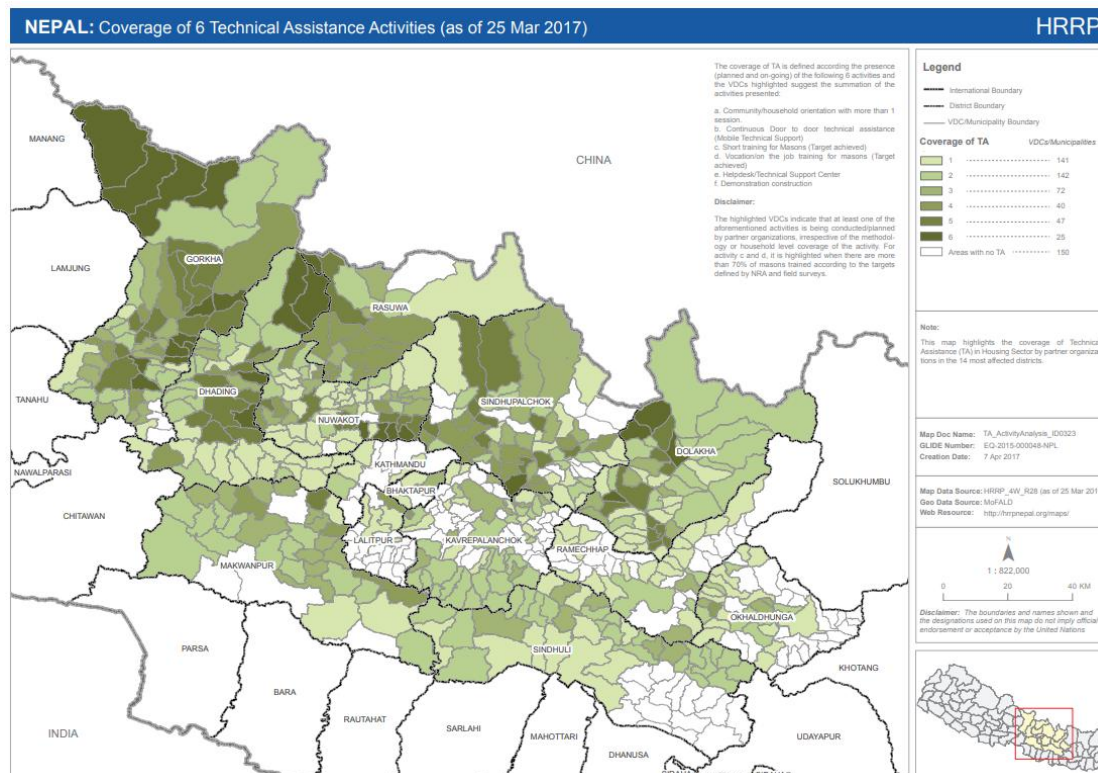


Figure 6: Coverage of technical assistance out of the 14 affected districts.

## 2.4 Participant selection

In every ward, a sample size has been calculated based on the affected households using [steekproefcalculator.com](http://steekproefcalculator.com) (Steekproefcalculator, 2018). The confidence level need to be 90%, a margin of error of 5% and a response distribution of 50%. These numbers are chosen because these are standard numbers within a sample. If the numbers would be different the outcomes would not be reliable enough or the sample size would become to big and the target would not be reached. Based on this quota sample, in all wards the participants were selected based on a view condition named below, but after that the selection was random sampling

The first condition for the selection of the participant was that the participant must be an adult because adults will give more reliable answers. The second condition was that the participants must be actively involved in the reconstruction process. With this is meant that the participant must know some things about what they are building or what they are going to build and what kind of training they received, or reasons why their house was destroyed. The third condition is that only one of the household members will be questioned, to make sure not to get the same answers. The last condition or goal was to get a men women ratio of 50/50%, to see if there are



differences in the barriers and drives they face and if the motivation is different between the two genders.

Before the survey was held the interpreters made very clear that the participants would not receive any assistance or help directly from the research team. They also mentioned that the research team is an independent team so the participants did not get expectations from CRS-Nepal. There have been told that this research could help them in the future when another earthquake might hit them. The people were very willing to participate to the survey, mainly because the research team was from another country the people had trust in the team that it would improve some things in the future.

## 2.5 Collect and document

For this research it is important that all data is collected and recorded in a reliable way, this means that every research team has to follow the same steps to upload all surveys., below is described how this should be done.

For this research the KoBo-tool will be used (KoBo, 2018). KoBo is a tool to hold surveys with and is used very often by humanitarian researchers. Humanitarian researchers use this app because the app does not need any connection to fill in the surveys as long as the questionnaire is downloaded on the devices. The KoBo app can be downloaded on all Android and Windows devices.

The interpreters will ask the questions to the household member. The household member will answer the questions to the interpreter. The interpreters will be using the KoBo-tool app, to fill in the given answers. After the surveys are finished the research team must try to upload the finished surveys on the web, this can become difficult as there will be no coverage in large areas. If this is the case the research team must wait with uploading until they have connection.

After the research is finished and all surveys are uploaded on the web, it is possible to create an export file for SPSS. SPSS is a statistic program to analyse the results. With this program it is even possible to merge the results from the structural assessment with the results from the survey. The advantage of this is that the results can be compared with each other.

## 2.6 The Questionnaire for the research in Nepal

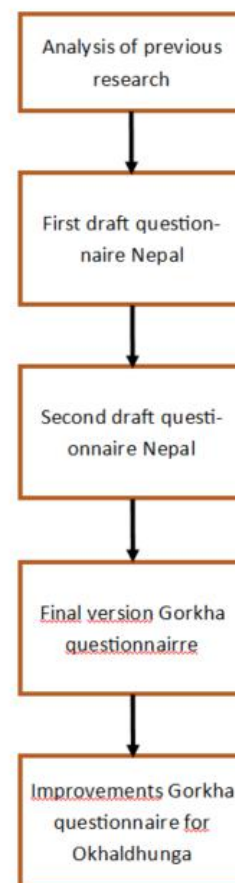
To create the questionnaire different steps need to be taken, to make sure the questionnaire is clear for everyone, people are willing to participate and the results are useful. The questionnaire is based on academic guidelines to design a survey.

Information like condition, language, the amount of questions and the order of questions are based on these academic principles (Baarda, De Goede, & Kalmijn, 2014)

Earlier studies provide aspects that are connected to the self-recovery process after a natural disaster (Dilling & Lemos, 2011). By studying the gaps in these documents, questions have been added related to the recovery process. Among others, the literature shows a gap in the information that is available on the decision-making process concerning the application of hazard-resistant construction principles. In 2017, Eefje Hendriks has held a similar survey in the Philippines to increase the insight around this decision-making process. The survey designed and used by Eefje Hendriks, and the analysis of the results will be used to develop an improved survey for the field research in Nepal.

In the picture on the right the different versions of the questionnaire can be found and which steps or information sources are used to improve the questionnaire. There have been made 4 major versions of the questionnaire. The first draft, the second draft, the final version for Gorkha districts and the improvements for Okhaldhunga district.

The questionnaire has been translated by translators recommended by CRS-Nepal based on positive earlier experiences. The translators have translated the questionnaire in couples and have later on passed the translation over to other couples of translators. This has ensured the quality of translation.



*Figure 7: Different steps taken to improve the questionnaire.*

## RQ1. MAO-model and trust for knowledge adoption

In this chapter the question; *“In what way can the barriers and motivators be measured in Gorkha and Okhaldhunga district in self-recovery and aided self-recovery communities via household surveys using the MAO-model and trust?”* is answered

The chapter explains why the MAO-model is chosen as a theoretical framework for this research. By analysing the data from the field research by Eefje Hendriks in the Philippines pops that motivation, ability, opportunity and trust are important barriers and motivators to extent the adoption of knowledge. Because these topics pops out a deeper literature study started to the MAO-model, model for motivation, ability and opportunity. It is important to implement the MAO-model in the survey because with this model the levels of motivation ability and opportunity can be measured. By measuring these different levels it is possible to say what might be barriers or drivers within the adoption of knowledge (Wiggins, 2004). According to Mia Stokmans, the higher the level of motivation, ability and opportunity the higher the likeliness of adoption taken place (Stokmans, 2005). So by implementing the MAO-model in the survey there can be designed new strategies to provide people with knowledge, based on improving the low level aspect(s). The MAO-model allows the categorization of participants in groups based on a high or low score for these determinants. The MAO-model also supports designing suitable strategies to promote wider adoption. Next to motivation, ability and opportunity, ‘trust’ is analysed as literature has shown that it is also of significant influence on the adoption process in the communication (Hendriks, Luyten, & Parrack, 2018).

The MAO-model has never been used before in the context of recovery processes. The MAO-model is mainly used in the social sciences like investigating the role of MAO on travel intentions (Petrick, 2016) and the engagement within local community festivals (Jepson, Clarke, & Ragsdell, 2013). After analysing the MAO-model implemented in the social science there has been concluded that it could be interesting to implement the MAO-model in combination with ‘trust’ in an research to self-recovery. This model can bring a new insight in research about the recovery-process. By analyzing these different documents and the report from Mia Stokmans (2005) about the implementation of the MAO-model it was possible to define what motivation, ability, opportunity and trust means in the context of this research. According to Hendriks et al., the MAO model and trust are important variables in the knowledge exchange model, see below.

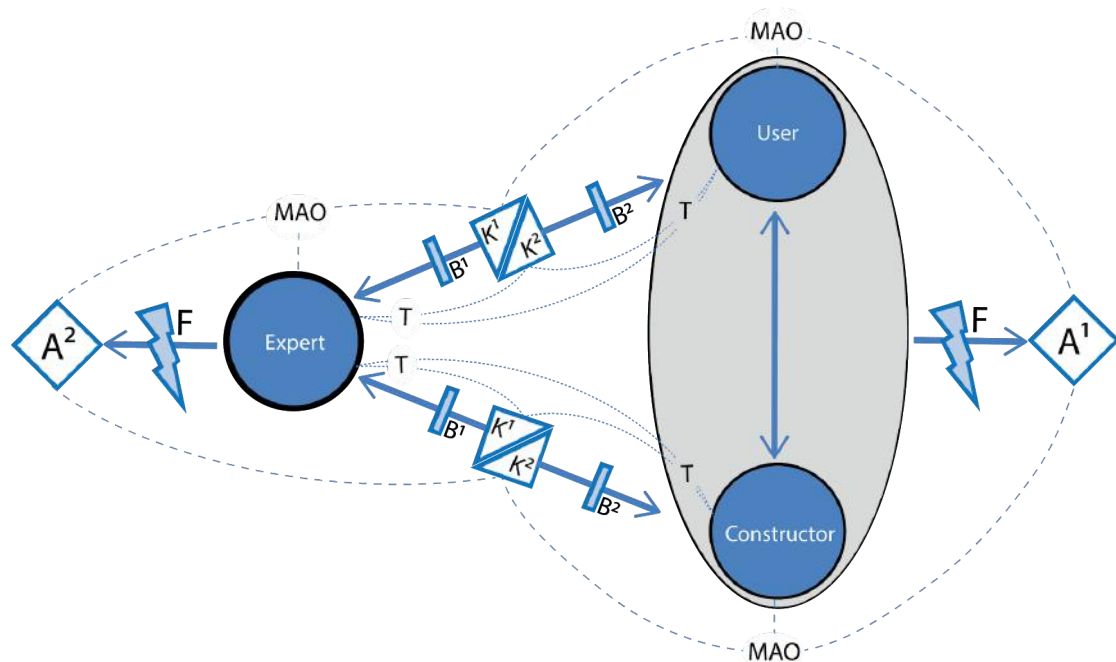


Figure 8, knowledge exchange model (Hendriks et al., 2018).

This model describes in which ways knowledge can be exchanged and where their are barriers. The MAO-model provides indications on how to measure those aspects in practice. With the results of all the questions from the survey it is possible to define the level of motivation, ability, opportunity (Brinkman, 2009) and trust. Out of all the answers it is possible to conclude which aspect is or are driver(s) and which might be a barrier(s).

The research methodology chosen for this research is the MAO-model. All questions in the survey are based on the MAO-model and trust. Each question contains information about one or more of the 4 topics.

### 3.1 MAO-model and trust for adoption

Out of the limitations form the work of rogers, professor of rural sociology, the MAO-model is derived. Rogers provides a theoretical background about the adoption of innovative and preventive knowledge. He also divides the adopters in different categories such as: innovators, early adopters, early majority and late majority (Rogers, 1962). Rogers has found 5 important stages: Knowledge, persuasion, decision, implementation and diffusion, these stages are important in the diffusion process. The research of Rogers is an important basis for later researches about adoption of knowledge. However for this research the definition of adoption aspects are different than Rogers described.

The MAO-model provides theoretical background for adoption with measurable criteria based on Motivation, Ability and Opportunity (Wiggins, 2004). The MAO-model provides an overview of understanding motivators, and enablers in behaviour. The MAO-model is a global framework that can be used to segment actors based on the extent of barriers they experience when being introduced to a new product. In the context of this research, the product is the knowledge to build back safer. For this research it is important to define the meaning of motivation, ability, opportunity and trust very clear because, the MAO-model has never been used before in this context.

According to the MAO-model people experience three different aspects to a specific extend that determine the probability of adoption of knowledge. These barriers are (Wiggins, 2004) (Hendriks et al., 2018):

- The motivation, defined as the desire to act
- The ability, defined as having the skills or proficiency to act.
- The opportunity, defined as the absence of environmental barriers to action.

Some consumers have overcome all barriers, and have a large probability of adoption. Other consumers experience some barriers to a certain extent. Consequently, they have a smaller probability of adoption. In the context of this research the 'consumers' are the participant of this research.

### 3.2 Definition of motivation, ability, opportunity and trust

In this chapter the three aspects (motivation, ability and opportunity) will be defined in the context of this research. Motivation are opinions of local people about the level of their knowledge . Ability are facts about the knowledge of local people. Opportunity are the needed facts, what does the local people think they need to know about a safe house. The meaning of the three aspects is formulated together with Mia Stokmans.

#### Motivation

According to Wiggins motivation is defined as the desire to participate (Wiggins, 2004). Mia Stockmans (as cited in Stokmans,2005) cited motivation as '*a process variable that may result from the activation of beliefs about the cultural participation (Stokmans, 2005; Fazio, 1990). The beliefs a consumer holds about participating in the cultural domain, is known as the attitude toward the cultural behavior.*' and Hendriks, Luyten and Parrack (2018) cited it as '*The motivation is about what is pushing action forward or backward and results from the activation of beliefs about*

*participation, including positive and negative associations with the activity (M. Stokmans, 2005)'.*

In the context of this research motivation is defined as the motivation to apply earthquake resistant techniques, the willingness to learn more about earthquake resistant construction principles and the understanding of safety. In the questionnaire this will be integrated as the kind of safety the participants strive for and if they will apply techniques. If those goals are close to what is advised by the institutions that give technical guidance it is more likely that they will apply the knowledge when they are also able and have the opportunity. Also the image that people have of a safe house and the degree to which this matches with the guidelines provided by the government and humanitarian organisations will be integrated. As last the understanding must be measured this will be done by questioning why houses were destroyed or why houses stand and ask about the added value of earthquake resistant principles.

#### Ability

The ability to participate is defined as having the skills or proficiency to act (Wiggins, 2004). This barrier should encompass all personal resources of a consumer, and not only the mental capacities (M. Stokmans, 2005). This construct is related to the resources, identified in cultural sociological research, that affects the level of participation. There are three resources that are important, namely time budget, financial budget and cultural competence (mental resources to interpret the cultural activity) (Graaf & Ganzeboom, 1990). Ganzeboom also identifies that, the physical capacities of a person can be regarded as a resource. Each resource will be elaborated on successively.

In this case, ability consists of personal resources; (1) is the knowledge they have and can receive or search on how to construct a safe house and the level of understanding they have of the available knowledge, (2) the time they have to construct a safe house, (3) the skills they have to construct a safe house, (4) the physical ability and (5) the money and financial resources they have to construct a safe house. By dividing the ability into these 5 aspects it is possible to identify which aspect is a barrier, when analyzing the gathered data. Below an explanation of all 5 aspects.

*1)The knowledge they have and can receive or search on how to construct a safe house and the level of understanding they have of the available knowledge*

The main question to ask *'Do they understand what earthquake resilient techniques are and has each individual the understanding and knowledge required to reconstruct their house with these techniques?'* If this question can be answered it is possible to



say if that individual has the ability for this aspect. Lack of this resource implies that the current knowledge does not exist within the participants or they do not know what to do with the knowledge

*2) The time they have to construct a safe house.*

This aspect regards the amount of leisure time available, as well as the dissipation of leisure time to reconstruct their house. Hypothesized by the research team is that, a positive relation is expected between the amount of leisure time and the speed of the reconstruction (If they build their house self). As well as, the more time they can spend on building their house the better the quality will be. However before taking conclusions from this it has to be proved by comparing the survey and structural assessment with each other.

*3) The skills they have to construct a safe house.*

This describes the skills of the household on the construction side. With this is meant what can the household owner do by him- or herself, is the house owner an handyman or not, is the family big enough to work as a team, conditions like that.

*4) The physical ability.*

Is an individual physically fit to reconstruct their house? This resource is of special interest if the community regards senior citizens, people with disabilities, and skilled/unskilled people.

*5) The money and financial resources they have to construct a safe house.*

This aspect regards the amount of money available to spend on the reconstruction of their house. This resource is related to income, and the money available in another way. Other available sources of money could be a loan, receiving money from family members working abroad or selling goods. The BBS research team hypothesize that the larger the financial resources the better the quality of the house and the faster the house will be build. However, financial ability also includes what priority they give to build a safe house. This also includes their preparedness or willingness to pay for safe housing. How much are they willing to pay for a more earthquake-resistant construction?

Opportunity

The opportunity to participate is defined as the absence of environmental barriers to action (J. Wiggins, 2004). In the context of this research it means: the available resources, the resources participants think they need to reconstruct their house in a more earthquake resistant way. The opportunity to choose a location, design, labourer or material type. The purchase intention, will the participants use it in the future or what would they do next time. For example *'How much money does the*

*participant think he/she needs to reconstruct their house?’ or ‘What would you do different if you have to build a house again?’.*

### Trust

In the context of this research trust is defined as; the trust people have in the trainer and the trust they have in the provided knowledge. So people might trust the provided information more when it is provided by a NGO instead of an INGO, for example. Or people might have less trust in the provided knowledge when each trainer tells them different methods.



*Figure 9: Participant with his temporary house.*

## RQ2. Measurement of the level of motivation, ability, opportunity and trust.

This chapter will answer the following question; *'In what way can the level of motivation ability, opportunity and trust be measured by means of a questionnaire and identify group and strategies?'*

This chapter describes how to measure the level of motivation, ability, opportunity and trust and what to do with it. After the level of motivation, ability, opportunity and trust has been determined it is possible to group people on the basis of a high or low level of the four aspects.

### **Measurement strategies**

Motivation, ability and opportunity can be measured in a few different ways. One of these methods is to let the participant answer in a 5- or 7-point scale (Batra & Ray, 1986). An example of such a scale is answer categories from 'not important' to 'very important' on question about their motivation, ability or opportunity. The second one is to count the answers given under one of the three subjects of MAO, and make a scale for yourself (Gruen et al., 2005; Pelletier et al., 1998). The third method is to first classify the motivation, ability and opportunity in smaller categories (Gruen, Osmonbekov, & Czaplewski 2005; Pelletier, Tuson, Green-Demers, & Noels 1998). For example, Pelletier divided motivation in the following three aspects; intrinsic motivation, extrinsic motivation and amotivation to measure the level of motivation why people do certain things for the environment (Pelletier et al., 1998).

### **Suitability within data collection**

The method of answering the question in a 5- or 7-point scale is not the most practical method for this field research because of the potential freedom of interpretation of the enumerators. For example, an enumerator could interpret 'very motivated' while the participant meant 'motivated'. The Common Feedback Project of the UN, has worked with scale card with emoticons to take answers in scales but we have chosen not to do so.

At this stage of understanding of knowledge adoption in post-disaster reconstruction, qualitative research is most valuable and therefore the survey consist of mostly open questions that are later on categories. The questions are asked by enumerators to participants and participants will give an open answer. In this research, we have chosen not to introduce answers with scales as outcomes are expected to be more reliable if the enumerator only translates and there is less room for interpretation. Besides that, the use of the scale card is more time consuming and would involve higher expenses in the field. Due to these interpretation errors and the limited survey

experience of our interpreters, we expected the data to be most reliable when scaled answer categories were avoided.

### **Suitability of measurement strategy**

The method to count the amount of positive and negative answers to make a scale for the level of motivation, ability and opportunity is a more suitable method for this research purpose (Gruen et al., 2005; Pelletier et al., 1998). Paul Weith, Levente Littvay and Andre Krouwel made a similar scale for their research about reconsidering the role of cognitive ability in the acquisition of political knowledge. *"We use the additive of correct answers to quiz-like questions for constructing our political knowledge scales and our cognitive ability scale. Cognitive ability was measured by counting the correct responses to the six most reliable of the seven items; the seventh item had no contribution to scale reliability and was dropped due to considerations of parsimony."* (Weith, Littvay, & Krouwel, 2012) The interpretation of motivation, ability and opportunity is a bit different for this research but the way of measuring can be the same.

In this study, all questions about motivation as well as ability, opportunity and trust are grouped together based on the description in RQ1. Each answer given for each question can indicate if the participant is motivated, able to or has the opportunity. This has been specified in RQ1. By setting a scale for the amount of positive answers the level of the aspects can be measured.

In this research a scale is proposed. This scale is based on the fact that a high application was measured in the districts and therefore adoption was considered high. Therefore, it is expected that all three were high. This decision is not based on literature but a conversation with Eefje Hendriks and an analysis of the results and main findings. When looking at the different questions it is estimated that scale could be as follows:

- From the questions related to one of the aspects, the outcome is considered high in case of 60% positive answers, average between 30% and 60%, and low in case of less than 30%.

For this research the 3-point scale, of low, average, high, would be useful to measure the level of motivation ability and opportunity. Important to mention is that when two or more questions are about the same topic they can not be counted twice. For example if a participant answers he or she received door-to-door training and face-to-face training, only one of the two can be counted to consider if there ability is high or not.

## 4.1 Measurement items

To measure the level of motivation, the motivation will be divided in two categories, intrinsic motivation and extrinsic motivation.

- Intrinsic motivation is defined as *“the innate tendency to engage in an activity for the sole pleasure and satisfaction derived from its practice. An intrinsically motivated individual acts out of personal choice and interest.”* (Pelletier et al., 1998). In the context of this research it can be interpreted as the tendency to build back a safe house or to gather information on hazard resilient construction. This tendency could be influenced by a number of aspects namely; 1) the status of the participant within the community and the potential perception of others due to the intended behaviour, 2) the utility of the intended behavior, 3) the self-efficacy of the intended behaviour, 4) the beliefs in the positive impact of the behavior, 5) the perceived positive and negative consequences of the behavior. . In the end it is the participants own choice to do something or not but these aspects could influence the personal choices.
- Extrinsic motivation is based on instrumental behaviors. Extrinsic motivation can be referred to non-self-determined behavior. With non-self-determined behavior is meant the involvement of others during the recovery or adoption of knowledge. In the context of this research extrinsic motivation is most related to sharing knowledge and willingness to help others (Pelletier, Tuson, Fortier, Vallerand, & Brière, 1995).

In summary, with intrinsic motivation is mainly meant the personals choice to do or not to do something and extrinsic motivation is mainly the willingness to receive and give assistance and knowledge others.

Ability entails the access to capacities(mental and physical) and resources. To measure the level of ability, different categories will be determined. The categories are; 1) access to knowledge, 2) prior knowledge, 3) access to skills, 4) financial resources and 5) available time. These categories are based on a conversation with Mia Stokmans (expert in the MAO-model) and Eefje Hendriks (Expert in self-recovery).

Based on Bloom’s taxonomy, see figure on the next page, the people face different levels of ability. namely: remember, understand, apply, analyse, evaluate, create. The level of ability is the highest when people are able to create an own design and the lowest when they can only remember the provided knowledge.



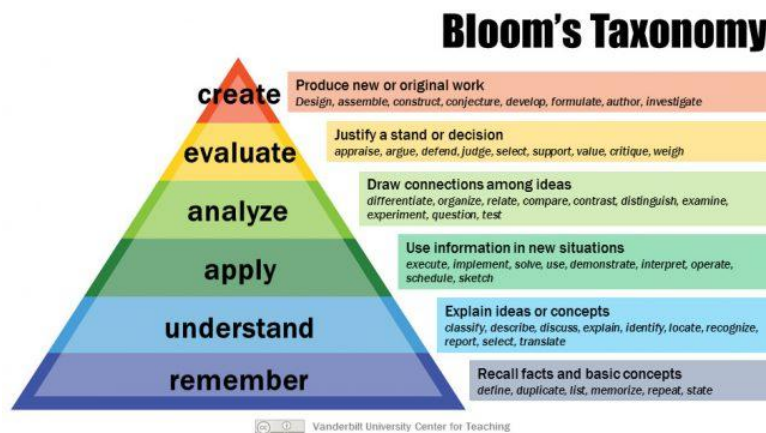


Figure 10: Bloom's taxonomy.

The ability is mainly about the personal ability, whereas, opportunity is more about the context related conditions in general that are out of the influence of the person interviewed. The opportunity is also divided in different categories namely; 1) available materials, 2) available knowledge, 3) promotion of knowledge, 4) quality of materials, 5) quality of knowledge, 6) available locations to construct. In these categories the personal perception is included of what people expect to need in order to act or learn.

The part about trust can be divided in two categories; 1) the trust in the actors communicating the knowledge, and 2) the trust in knowledge that is shared. These two categories are chosen because knowledge cannot be adopted because a lack of trust in the sender or a lack of trust in the knowledge itself (Tromp and Bots, 2016).

All categories for motivation, ability, opportunity and trust are visible in the table in appendix number 1 'Question distribution table of MAO-model and trust'. This table contains all relevant questions from the household survey divided into the different categories of MAO and trust. In this appendix, the answer possibilities of the questions that are presented twice in the table, are specified for different constructed categories.

Before the level of each constructed category can be measured, a significance analyse needs to be made. This means that, for each question needs to be checked if the differences that are found are of significant influence on the defined overarching category. A factor analysis can be conducted to do so. If differences are not significant it must be taken into account when drawing the conclusions, and they should be removed from the constructed category, because the results of that question are not reliable enough for the measurement. To actually measure the level of motivation, ability, opportunity and trust, there must be a clear percentage of positive answers to say if a category is high, normal or low. This scale has been



earlier defined. If less than 30% of the answers is positive the level is low, if the percentage of positive answer lays between 30% and 60% the level is normal and if the percentage is higher than 60% the level is high.

## 4.2 Defining strategies

By measuring motivation, ability and opportunity in practice the affected population can be grouped based on motivation, ability and opportunity. If participants have a high score for all three aspects the probability of knowledge adoption is expected to be high. This is the case for the group of innovators and early adopters. If the level on one or more aspects is not high, an approach need to be defined to increase knowledge adoption. Based on the characteristics of the group a suitable method to communicate knowledge can be distinguished.

The best way to group the population is to merge 2 different groups, namely 1 aspect they both have and 1 aspect the first group has and the other group has not (Stokmans, 2005). This is a good way of grouping people because by doing so, this people can learn or increase awareness. Because both groups have something in common, such as a high motivation, ability or opportunity they will be more likely to trust each other or speak the same language, because they are on the same level.

- If both groups have a high motivation but one group has a low ability and the other group a high ability. The participants with a low ability can learn from those with a high ability.
- If only the opportunity is low this is something that has to be arranged for the target groups as they have no direct influence on the opportunity. It is wise to discuss possible strategies to enlarge opportunity with the community.
- If abilities are comparable but the motivation is different, those with a low motivation can be inspired by those with a high motivation.
- If the opportunity is low in one group the opportunity is high in the other group. This means people can support and learn from each other.

The table below presents on how to make the selection, with this table each community or part of the community can be defined. According to Mia Stokmans this is a good way of grouping people for an intervention.

	motivation	Low		high	
	ability	low	high	low	high
opportunity low					
opportunity high					

Figure 3: Group distinguish method, with level of motivation, ability and opportunity (M. Stokmans, 2005).

## RQ3 Development of the questionnaire

In this chapter the question: *"In what way can the questionnaire be adapted to the practical limitations in Nepal and ensure reliable results?"* is answered.

This chapter discusses the field research dates, selection of communities and the respondents, reliability of the data, the team composition, the collection tool and the development of the questionnaire.

### 5.1 Field research dates

The fieldwork has taken place in at 2 different time lapses. The first one was in Gorkha district and has taken place from 28-02-2018 to 21-03-2018. In the first week there has been made improvements on the questionnaire, and the method how to hold the survey. In this week the interpreters have been trained, how to ask the questions and how to fill in the questionnaire on the devices. The fieldwork has really started on the 4<sup>th</sup> of march, after one week and lasted until 19<sup>th</sup> of march. The team split up in 3 different smaller teams to target more communities. In total the team did the survey in 8 different wards, the first team did Aaruarbang and Swara, the second did Bunkot, Gyalchowk and Bakrang and the third team did Lapu, Keroja and Sirdibas.

The second time-lapse from the fieldwork was from 20-03-2018 to 12-04-2018. The first few days were to improve the survey and train the new interpreters. There have been made some changes in the questionnaire. The questions are improved and some questions are deleted and others are added, answer possibilities were added, the order of questions is changed, and the translations to Nepali are improved. On the 25<sup>th</sup> of march the teams went to the field until the 8<sup>th</sup> of april, to do the research. Again the research team split up in three smaller teams. The first team went to Bhussinga, Kaptiguna-2, Kaptiguna-8 and Khijichandeshwori. The second team went to Singadevi, Raniban, Ratmate, Kalikadevi, Fulbari, Harkapur and Tulachap, and the third team went to Pokali, Ragani, Khijiphalate, Jantarkani-1 and Jantarkani-9.

In appendix number 2 'General ward data' the ward assessments can be found. In these assessments are the different types of received (technical) assistance described. As well as the accessibility of each ward and the average income of the inhabitants.

### 5.2 selection of the participants.

The results from the survey show a ratio of 55.4% men and 44.6% women. These results are rather close to the 50/50% ratio, so the goal of men women ratio is

achieved during the field research. A different number of participants has been conducted in each ward. Below an overview of the amount respondents in each ward.

### 5.3 Respondents

In total were conducted 1457 surveys, divided over 26 wards. From the 26 wards, 8 are located in Gorkha district and 16 in Okhaldhunga district. All respondents are strictly anonymous, there are no names noted or any other information related to the respondent. All respondents have given individually vocal permission to publish their answers. This vocal permission is recorder for each survey.

The goal was to get a men women ratio of 50/50%. The results from the survey show a ratio of 55.4% men and 44.6% women. These results are rather close to the 50/50% ratio, so the goal of men women ratio is achieved during the field research. A different number of participants has been conducted in each ward. Below an overview of the amount respondents in each ward.

- Aaruarbang	42	- Keroja	132
- Bakrang	70	- Khijichandeshwori	50
- Bhussinga	54	- Khijiphalate	77
- Bunkot	127	- Lapu	64
- Fulbari	61	- Pokali	78
- Gyalchowk	64	- Ragani	69
- Harkapur	52	- Raniban	53
- Jantarkani-1	84	- Ratmate	46
- Jantarkani-9	49	- Singadevi	54
- Kalikadevi	33	- Sirdibas	43
- Kaptiguna-2	41	- Swara	46
- Kaptiguna-8	24	- Tulachap	40



Figure 11 Community attendance for the FGD for men.

## 5.4 Reliability

In every ward, a sample size has been calculated based out of the affected households, that enables a 90% confidence level, a margin of error of 5% and a response distribution of 50%. Based on this quota sample, in all wards the participants were selected based on random sampling. The only condition was that their house was damaged or cracked by the earthquake. The interpreters visited all houses together with a member of the BBS research team. The team members from the BBS research team joined the survey to help the interpreter if they did not understand something and to supervise. The interpreters are trained to select an equal amount of men and women for the questionnaires. Only household members above 18 years of age were considered eligible to participate.

To be sure that the communities can be compared with each other a Chi-Square test will be done. This will be done on a few aspects so see if the communities are similar enough to be compared. The tested aspects are the gender and the ethnic group. The remoteness would be a good aspect to test, but this aspect is not included in the survey.

The outcomes of the Chi-square test must be well-interpreted. The outcome is significant if the change that a difference has arisen by change is less than 5%. The outcome is very significant if the change that a difference has arisen by change is less than 1%. This means that the SPSS outcome must be that P is less than 0.05.

### Gender significance

The gender difference is very significant as visible in the table below. This means that the change in the difference between the district is very unlikely to be a coincidence.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	57,956 <sup>a</sup>	23	,000
Likelihood Ratio	58,662	23	,000
Linear-by-Linear Association	,203	1	,652
N of Valid Cases	1453		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 10,69.

Table 1: Chi-square test gender significance.

## Significance in ethnic group

The differences in ethnic groups are very significant as visible in the table below. This means that the change in the difference between the districts is very unlikely to be a coincidence.

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	123,794 <sup>a</sup>	4	0,000
Likelihood Ratio	138,087	4	0,000
Linear-by-Linear Association	71,286	1	0,000
N of Valid Cases	1433		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,32.			

Table 2: Chi-square test Ethnic group significance.

## 5.5 Research team

During the field research in both districts, the build back safer (BBS) research team split up into three smaller teams. Each team consists of two or three members from the BBS research team and 2 or 3 enumerators. The main task of the members from BBS research team was to lead everything in the right direction. Think of things like accommodation, finding all the right participants, stimulate and control the enumerators and payments. The main tasks of the enumerators were to hold the survey and structural assessment, lead the focus group discussions, and hold the key-stakeholder interviews.



Figure 12: The build back safer research team.

## 5.6 Development of the questionnaire

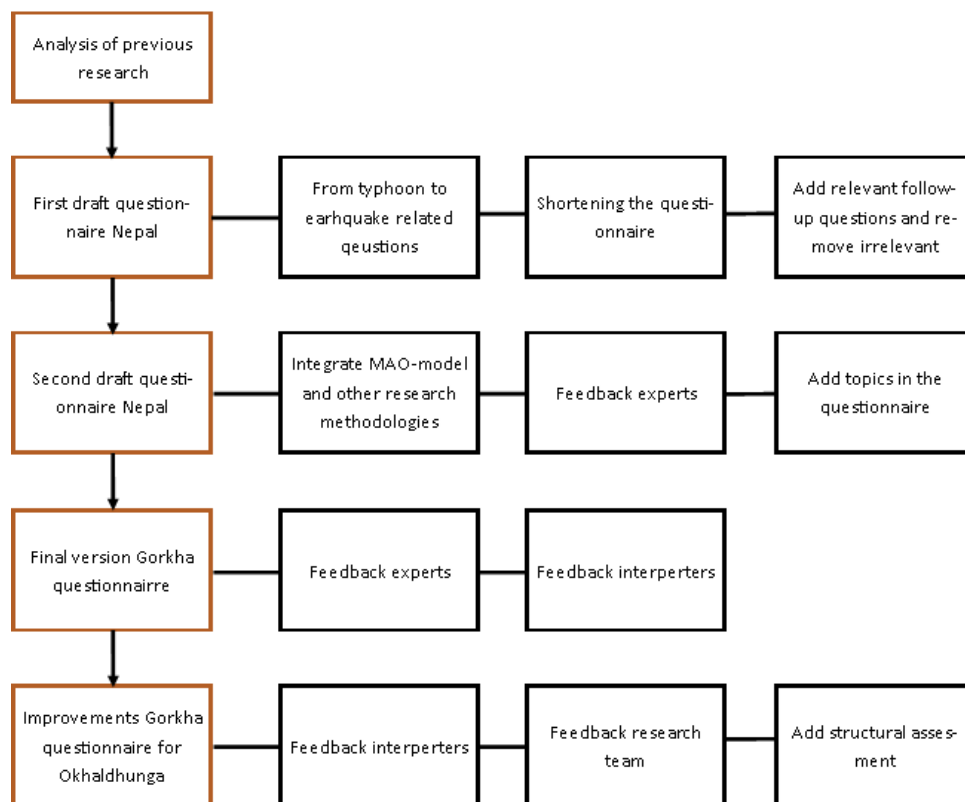
This chapter describes how the questionnaire has been created. There have been taken different steps to create the questionnaire, with each step the questionnaire is improved. All the taken steps will be explained in this chapter. During the fieldwork the questionnaire is improved as well, mainly after the field research in Gorkha to improve it for Okhaldhunga.

This survey is based on academic guidelines to design a survey. Information like condition, language, how many question and the order of the questions are based on these academic principles (Baarda, De Goede, & Kalmijn, 2015, Basisboek enquêteren)

Earlier studies provide aspects that are connected to the self-recovery process after a natural disaster (Dilling & Lemos, 2011). By studying the gaps in these documents, questions have been added related about the recovery process. Among others, the literature shows a gap in the information that is available on the decision-making process concerning the application of hazard-resistant construction principles. In 2017, Eefje Hendriks has held a similar survey in the Philippines to increase the insight around this decision-making process. The survey from Eefje Hendriks, and the analysis of the results will be used to develop an improved survey for the field research in Nepal.

On the picture on the next page the different versions of the questionnaire can be found and which steps or, information sources are used to improve the questionnaire. There have been made 4 major versions of the questionnaire. The first draft, the second draft, the final version for Gorkha districts and the improvements for Okhaldhunga district.





### 5.6.1 Analysis of previous research

Before developing the new questionnaire a previous used questionnaire is analyzed. This questionnaire was developed by Eefje Hendriks. She held this questionnaire in the Philippines, where she focused on typhoon resistant building and the adoption of knowledge. This questionnaire itself is analyzed to see how she build the questionnaire, to see how she asked the questions and what kind of questions she used. The gathered data with the questionnaire is also analyzed to see what the outcomes of all questions are. By analyzing the results it is possible to determine which questions contains valuable information, which are not relevant and which questions people did not understand or did not answer.

### 5.6.2 First draft questionnaire Nepal

As a basis for the first draft the questionnaire from Eefje Hendriks is used, this questionnaire and its data is already analyzed. In this draft their have been made three major development and adjustments. The first one is to change all questions from typhoon to earthquake related questions, and also change the answer categories to Nepal relevant answers. The second improvement is to shorten the questionnaire. This means remove irrelevant questions for the focus of this research,



combine questions and remove double questions. The third and last improvement is to add new questions that logically follow from the literature study, and add follow-up questions to questions we want more information about.

Changing the questions from typhoon to earthquake related questions was not very hard. mostly it was just change the subject. For example '*Do you feel your house is safe in case of a big/small earthquake?*' this is the new question. The old question was '*Do you feel your house is safe in case of a storm?*'. Shortening the questionnaire was harder. There had to be a good reason to remove the removed questions.

The main reasons why questions were removed are:

- Questions related to the quality of the building. These questions are removed because the answers can be found in the structural assessment.
- Questions related to the early recovery. These questions are removed because this research is about the adoption of knowledge and not about the early recovery, that is a different
- Double questions. There were not two of the same questions, but some question were so the same that they did not need to be asked both.
- Questions related to the amount of money people have and earn. These questions are removed because we expect that people will not give honour answers. With this question it is also possible that the participants create expectation, that they will receive money from this research team.

All adjustments of this version of the questionnaire can be found in appendix number 3 'Improvements from questionnaire Philippines to first draft'. The whole improved questionnaire can be found in appendix number 4 'First draft questionnaire Nepal'.

### 5.6.3 Second draft questionnaire Nepal

This version of the questionnaire is an improvement on the previous first draft and the MAO-model and trust is integrated. The improvements are mostly the way questions are asked, the answer categories, the questions are divided in different subjects and some irrelevant questions are removed out of the questionnaire. The MAO-model and trust is integrated. This means that for each question has been decided if the question was about motivation, ability, opportunity and/or trust or if the question is relevant for another research methodology. Mia Stokmans has given comments on the old version from the questionnaire and gave as feedback to determine which questions are about motivation, which about ability and which about opportunity. By doing this, it is later on easier to see where the barriers might be, motivation, ability, opportunity or trust.

The new questionnaire can be found in appendix number 5 'Second draft questionnaire Nepal', in this appendix for each question is added for which research method the question is relevant and if the question is about motivation, ability, opportunity or trust.

The questionnaire is divided into different topics so it is easier to analyse the questionnaire quickly. By dividing the questionnaire into different topics it is possible to make a logical order of questions and it is easier to see if all the important questions for a specific topic are in the questionnaire. The questionnaire contains the following topics:

- General data
- Recovery process
- Planning process
- Knowledge needs
- Construction actors
- Construction process
- Technical assistance
- Construction materials
- Material source
- Safety
- Priorities
- Satisfaction
- Future
- Livelihood
- Gorkha questions

There have been added 3 different topics in the questionnaire. The questions for the social network analysis, the questions about the governmental tranches and the question about received assistance. All team members have given feedback on the questionnaire and gave suggestions for adjustments. The main suggestion was to add questions for the social network analysis (SNA), this is another research method. There have been added ten questions related to the SNA, these questions are mainly about who provided help to the participants, what type of help and how many times did they receive that assistance. Questions about the governmental tranche are also added in the questionnaire. In Nepal people can apply for governmental money if they build according to the government guidelines. This research wants to know how many people applied for the tranche and how many received some tranches. This because it is important for the quality and construction speed of the houses. Gorkha questions are added, this means that these questions will only be asked in Gorkha district. The questions are mainly about the received training and if the participant trusted the trainer and information. These questions are only asked in Gorkha because there have been given a lot of assistance in that district, and in Okhaldhunga they have received little to no assistance.

There have been removed about fifty questions. The main reason to remove the questions is the available time during the survey. The questionnaire cannot take longer than around 45 minutes, that is the main reason. However the questions who are removed have a reason to be removed. One topic of the removed questions are

the questions about the material source. these questions are removed because the answers can be found in the results from the structural assessment. Another removed topic is the material supplier and the quality he delivers. These questions are removed because in Nepal most people gather their own materials and if they go to a supplier there is only one supplier available so they cannot choose between multiple supplier or the quality of materials. The third topic is about when an earthquake is coming and if the participants can limit the damage. These questions are removed because this research is not about when an earthquake is coming but about the adoption of knowledge. Some other removed questions have a specific reason why they are removed. These questions and the reason why they are removed can be found in appendix number 6 'Improvements from first draft to second draft questionnaire Nepal', this appendix contains all adjustments from the first to the second draft.

#### 5.6.4 Final improvements Gorkha survey

This is the last version of the questionnaire before the field research in Gorkha will start. After the research team arrived in Gorkha, the team have had some meetings with the staff from CRS-Nepal. They have given the advice to short the questionnaire even further, max 30 minutes, otherwise people quit the survey halfway. They also gave advice to add more or different answer categories which are more usual in Nepal. The questionnaire is presented to the interpreters. They indicated which questions they did not understand. The questions which were not clear are simplified, so the interpreters understand them. The topics for the questions are changed into more relevant topics and the order of questions is changed. Appendix number 7 'Gorkha Questionnaire', contains the final questionnaire for Gorkha district.

Below the new topics of the questionnaire in the order how they will be asked.

- |                                    |                          |
|------------------------------------|--------------------------|
| - General data                     | - Mason/ carpenter       |
| - Planning process                 | - Construction process   |
| - Knowledge needs                  | - Financial assistance   |
| - Received training or instruction | - Construction materials |
| - Applied techniques               | - Awareness              |
| - Construction actors              | - Priorities             |
|                                    | - Future                 |

Also in this version of the questionnaire there have been added and removed some questions. An important added question is '*Was your house (partly) damaged by the earthquake?*' this question is added because if the participants house was not damaged a lot of questions are not relevant for that person. CRS-Nepal asked us to add some questions about how people want information presented to them and

where they found information if they did not receive it, that is why some questions related to that are added. In the previous version questions in relation to the SNA were added. Some of these questions are removed in this version because these questions were more about the technical network analysis (TNA) instead of the SNA. Some other questions are removed on the advice of CRS-Nepal. They could already answer these questions for most of the people. The simplified questions and an overview of added and removed questions can be found in appendix number 8 'Improvements from second draft to Gorkha questionnaire'.

#### 5.6.5 Improvements Okhaldhunga survey

For the field-research in Okhaldhunga there have been made a few small changes in the questionnaire. The order of questions is changed to a more logical order. This means that the topics logic follow-up more logic than in Gorkha. Some questions are removed and others are added. Some questions are simplified, because in Gorkha the questions were not always clear enough. Answer categories are added after a quick analysis of the data from Gorkha district. Answers which were given often under the category others are added as a possible answer category for that question. Appendix 9 'Okhaldhunga questionnaire', contains the final questionnaire for Okhaldhunga district and appendix 10 'Improvements from Gorkha to Okhaldhunga questionnaire' contains the adjustments made to the questionnaire used in Gorkha district.

In Okhaldhunga district the structural assessment is added to the questionnaire. the interpreters will be trained to do the structural assessment. First the interpreters hold the survey to the participant and directly after the survey they start with the structural assessment. So, the survey questions and the questions from the structural assessment need to be combined to one questionnaire. This chapter only contains the adjustments on the survey questionnaire. But during the fieldwork the two will be combined into one questionnaire. This is chosen because to compare questions from the survey with questions from the structural assessment the right house must be combined with the right participant, and by combining the two into one this is automatically right.

### 5.7 Data analysis

In this chapter the way of data analysis will be described. First the data collection tool will be described. Afterwards, the mutation which have been made in the dataset using SPSS are described needed to clean up and prepare the dataset before the data analysis. This chapter also contains the data analysis method.

### 5.7.1 Data collection tool

All data is digitally collected. To collect all data, the app, KoBo is used. KoBo is an app which can be used offline. This is very important because in most areas there is no internet connection possible. The app was installed on different Android devices. For this research only, smartphones and tablets were used to collect the data. Each enumerator had a device to fill in the answers which the participants said. The questions and answers possibilities were in both English and Nepali available for the enumerators.

All finished surveys were stored on the devices. If there was internet connection the researcher tried to upload all the surveys immediately, to make sure the data could not get lost. If this was not possible the researchers did it as soon as possible when there was connection. All uploaded surveys can be found on the website from KoBo. All surveys are downloaded as excel file at once from the website, and then loaded into SPSS. SPSS stands for 'Statistical Package for the Social Sciences'. SPSS is a statistic program which is used to analyse all collected data. Later on in this chapter will be described how the data is analysed in SPSS.

### 5.7.2 Mutation in the raw dataset

This chapter contain all mutations made in the raw dataset. The data gathered in the field is converted to SPSS. In SPSS there have been made some mutation to clean-up the dataset, and make it more presentable. In the table below are for all questions the different mutations summed up. Some mutations are done on almost every question and other mutations are only done for some specific questions. Below the overview of all mutations for each question. See appendix number 11 'Mutations in the raw dataset' for all mutations.

### 5.7.3 Data analysis method

The first step in the data analysis is the frequency analysis. For each question the frequency is calculated using SPSS. All questions were plotted against gender, VDC-name and district. This means that the difference between men and women, all communities and the two different districts can be analyzed. These three are the most important topics to compare the questions on. After the frequencies are calculated in SPSS, the remarkable outcomes are highlighted for each question.

## RQ4. Results

This chapter will answer the following question: *“What are the main characteristics of the adoption process of hazard-resistant construction principles found by analysing different districts, communities, and genders in Nepal?”*.

This chapter describes all findings from the household survey. Each asked subject has its own findings and conclusions which will be described below. All tables and frequencies used for this chapter can be found in appendix number 12 ‘frequencies from gathered data’.

### 6.1 General data

In most wards, the gender sample varies between 40 % women and 60% men or 50/50%. Over all the communities 44.4% women and 55.6 % men are surveyed. In 5 wards the percentage of women is only 30%; Fulbari, Kalikadevi, Lapu, Ratmate and Thulachap. In Swara more women (69.6%) than men are surveyed.

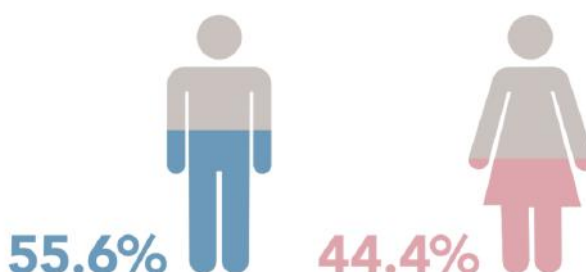
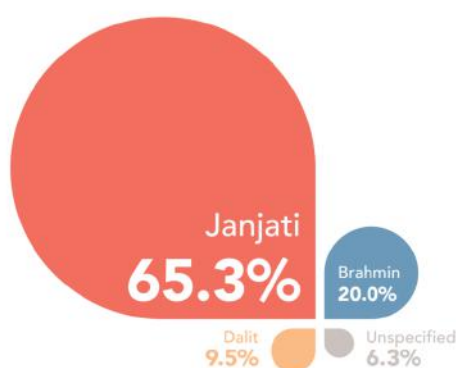


Figure 13: Gender sample.



The most common surveyed cast is Janjati (65.3%). After that comes Brahmin (20.0%), Dalit (9.5%) and a general cast (4.6%), see figure 5. In some wards, all people are Janjati namely, Jantarkhani-9, Kijiphalate, Swara and Kaptiguna-2. In Thulachap, most people are Brahmin (87.5%). There is a higher percentage of Janjati in Gorkha (77.3%) than in Okhaldhunga (56.9%), and in Okhaldhunga (26.9%) there is a higher percentage of Brahmin than in Gorkha (10.1%).

Figure 14: Ethnic group distribution.

In general, 53.7% works in construction in Gorkha district. An exception is Swara, where only 28.3% works in construction. The question related to this was only asked in Gorkha. This question was asked because in Gorkha there were extra questions



for people who work in the construction sector. In Okhaldhunga district is decided to ask these questions to all participants.

## 6.2 Planning process

In both districts, Gorkha and Okhaldhunga, 96.5% of the houses were damaged or cracked by the earthquake. Only in Bakrang around 22% of the participants did not mention that their house was damaged or cracked. From the damaged houses most of the people already started with the reconstruction of their house. In Gorkha district 89.8% already started and in Okhaldhunga 78.1% has started. In 3 wards in Okhaldhunga more that 60% of the people have not started with the reconstruction yet. The reason that the reconstruction rate is lower in Okhaldhunga could be that in there has been given less technical assistance.

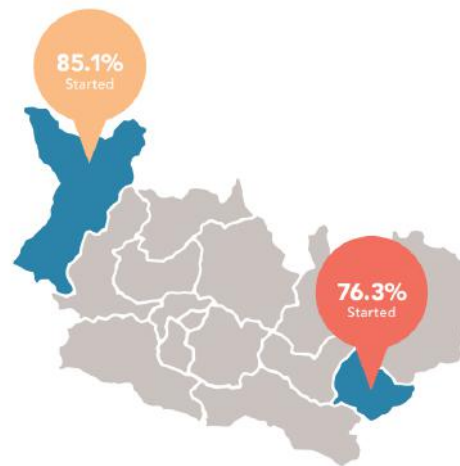
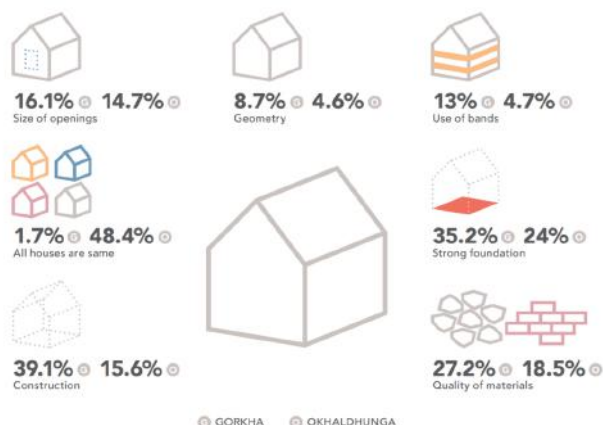


Figure 15: Percentage of who already stated with the reconstruction.

In Gorkha the most given reasons why the participants house was destroyed are because of the weak construction (54.3%), Low quality materials (21.2%), foundation was not strong enough (19.6%) and no earthquake resistant structure (26.4%), while in Okhaldhunga the most given reason was the earthquake affected it (59.5%). In both district people also mentioned that their house was destroyed because it was an old fashion house (28.8%). The reasons why other houses stood are the opposite from the reasons above. The most given reason was because these people used strong materials (26.8%). Especially in Gorkha they mentioned this (37.1%). In Okhaldhunga the reason was because they build on hard soil (32.0%). Also in a lot cases the participants mentioned that all houses were damaged (31.0%) or that they do not know why other houses stood (17.1%). More women (20.9%) than men (14.0%) do not know why other houses stand.

A lot of houses in Okhaldhunga district are regarded as being the same, namely in 48.4%. In Gorkha people named more specific aspects of the house, but also in Okhaldhunga people name those aspects. The quality of materials (22.6%), how to construct my house (26.5%), how to make a strong foundation (29.2%) and how to make an earthquake resistant structure (23.9%) are mostly mentioned. In Okhaldhunga district the participants mostly told that they copy "how to make a



strong foundation” (24.0%). This is understandable because most houses in Okhaldhunga are still only at foundation level, which is also visible out of the results from the structural assessment. In Gorkha district “how to construct my house” is the most given answer (39.7%). This can be explained by the fact that people had limited understanding on the construction of houses in general.

Figure 16: What aspect houses have in common with each other.

The communities in Gorkha show to have a more technical related reasoning behind the destruction of their house, whereas in Okhaldhunga the understanding is more superficial and mainly related to “the earthquake” and “houses being too tall”. The reason for this difference between the two districts could be that in Gorkha there has been a lot of technical assistance so people are more aware why, and the participants in Okhaldhunga district has received almost no assistance so they are less aware of the details around earthquake resistant housing.

Almost all participants made their house different than their old house. Important reasons, in both district, for that are the opportunity to get the governmental tranche (23.1%) and the earthquake itself motivated them (37.6%). More men (26.6%) than women (18.7%) are motivated by the opportunity to get the governmental tranche. In Gorkha the biggest motivator is to make their house stronger (50.8%), while in Okhaldhunga people are very motivated by the advice from an engineer (71.6%).

Not only people build their house different, some people also changed from location. In contrast to that other people did have an option for another location but decided to build back on the same spot. In both districts almost half the people did have another option for the location of their house (52.2%). In Kalikadevi (68.0%), Pokali (65.5%), and Ratmate (66.7%) people mostly

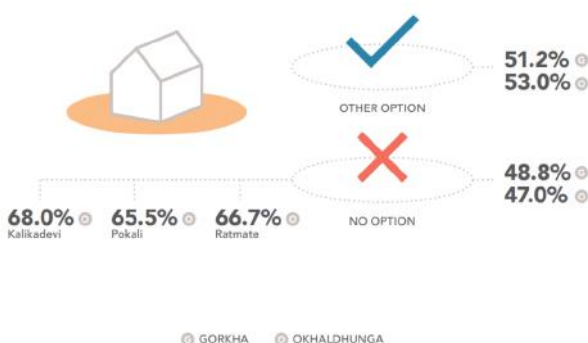


Figure 17: Percentage of people having another option for the location of their house.

did not have another option for the location. In Bhussinga, Fulbari, Kaptiguna-8, Khijichandeshwori, Thulachap and Kaptiguna-2 more than 70% of the people did have another option for the location. The biggest reason why all people, who had another option, choose for this location is because it was an engineer's advice. Especially in Bhussinga where 92.9% of the people said that.

### 6.3 Knowledge needs

In general, 67.5% of the participants made a design plan for the reconstruction of their house, but in 6 wards more than half the people did not make design plan. The main reason for both, men and women, why they did not make a plan, was because it was already done by the people who were going to build their house (53.1%). In Gorkha this was 71.6% of the participants and Okhaldhunga 32.9%. Another reason was that there was no technical support available (17.8%). In Okhaldhunga 31.9% of the participants give as reason that they have no access to government tranches of funding. A difference between men and women is that more men (26.4%) mentioned that there was no access to government funding, while the women said there was no technical support available (20.6%).

In both districts most of the participants searched for information, namely 86.2%. In Okhaldhunga 95.1% of the participants searched for information and in Gorkha this number is 70.1%. Most participants want to know what materials are safe (13.5%), what materials they should use in general (14.5%) and how to construct earthquake resistant (14.5%). For all answers, more participants in Gorkha than Okhaldhunga gave this answer. In Gorkha 59.7% of the participants said they want to know what materials are safe and Okhaldhunga 26.2%. what materials to use in general is answered by 62.8% while in Okhaldhunga only 28.6% did. In Gorkha 57.6% answered that they want to know how to construct earthquake resistant, in Okhaldhunga this was 31.9%. In Gorkha also a lot of people want to know where they can find a good mason (33.2%), How to construct in general (24.8%), how to construct earthquake resistant (36.7%) and what kind of foundation they should make (46%). In Okhaldhunga people often just want advice from an engineer (24.4%) they didn't have specific questions. With the gender perspective

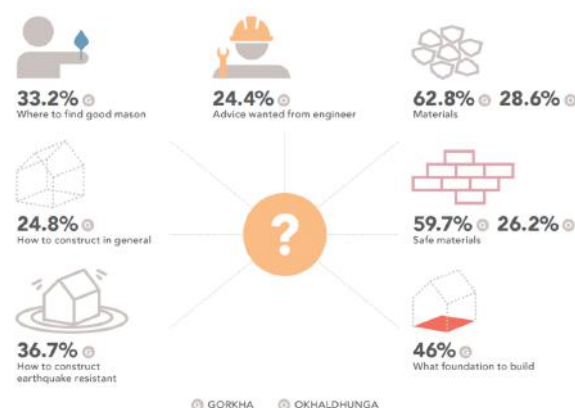


Figure 18: Information participants wants to receive.

it is visible that more men (23.4%) than women (15.5%) want to know how they should construct earthquake resistant.

The participants asked for information by an expert in building (37.4%), someone with more construction knowledge (30.8%) or government officials (33.1%). In Gorkha mainly government officials (48.4%) and Okhaldhunga mainly experts in building (41.6%). The information they received was seen in 92.0% as reliable. The reason the received information from the sources above are reliable because the sender was a trained person (21.6%) and the sender knows how to build safe/ earthquake resistant (17.6%).

Only in the ward in Lapu 22.0% of the participants find the information not reliable, but they do not really have a reason why. If people had doubts about the technical advice they received it was mostly about how to build a safe house (10.0%), but most of the people did not have any doubts (82.8%).

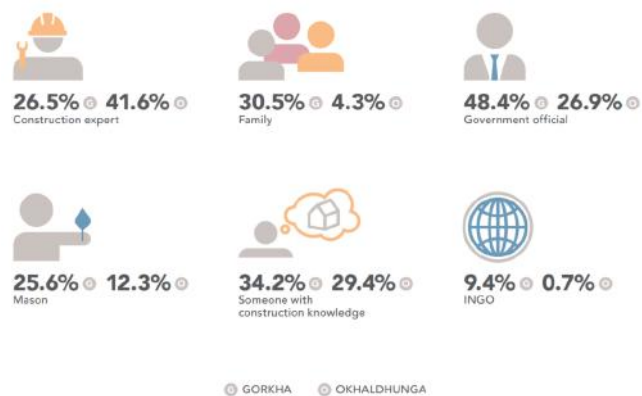


Figure 19: Information sources.

If people could not find the information they want themselves, they will go to engineers (30.2%) or the ward office (32.7%). Mostly the people in Okhaldhunga will go to the engineers (75.0%) and in Gorkha people will go to the VDC office (31.4%).

The main reason why, people did not search or ask for information, was because they had no questions (34.1%) or they were not interested to know more (12.7%). If the participants did have questions, the reason they did not search was because they did not know where to search (26.2%). Despite that, there is one VDC were 63.5% of the participants did not search for information, this is in Keroja. In Keroja people had two reasons why did not search for information namely, because they did not have questions (42.4%) or that they did not know where to search for information (33.3%). Even 10 out of the 24 wards did not have any doubts at all.

the most reliable sources of information are the radio (25.5%), door to door (27.0%) and engineers' advice (27.0%). Especially in Okhaldhunga they find the radio (34.2%) and engineers advice (43.6%), and in Gorkha they find door to door the most important (46.3%). This also results in how people want to have information presented to them. The most wanted way of receiving information is via face-to-face, 61.6% of the participants mentioned that as the way they want it. Face-to-face information is often presented by an engineer or Ngo that is one of the reasons people find engineers advice a reliable source of information. Radio (28.0%) and

demonstration house (22.2%) are the second and third most important sources of information.

## 6.4 Received training

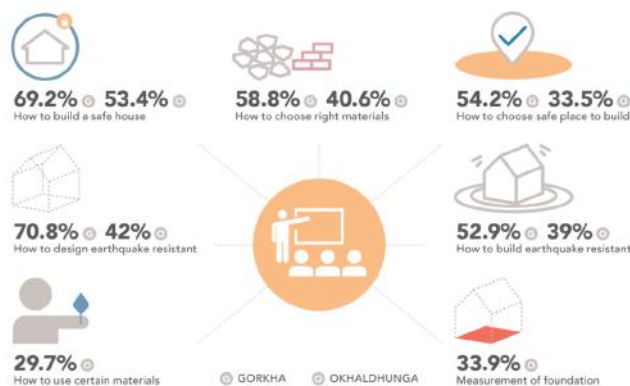
In Gorkha 54.9% of the people or the person who build the house received training. In Okhaldhunga this is 60.6%. These are remarkable results, because according to HRRP there have been given more training in Gorkha district than Okhaldhunga. While according to the survey more people or the mason in Okhaldhunga district received training than in Gorkha district. The division between men and women is that around 10% more men received training than women did. The reason this result came up to one question is because the question was also about if their mason received training. In Okhaldhunga 57.0% of the people mentioned that their mason participated in some sort of training, which explains the high number of received training in Okhaldhunga. The people who received training themselves in Okhaldhunga mainly received a short training from 5-7 days. In Gorkha people received a lot more training themselves namely: demonstration house (42.6%), door-to-door assistance (21.8%) and a short training (21.1%). This means that the inhabitants of each ward in Gorkha have more knowledge about how to construct earthquake resistant than in Okhaldhunga.



Figure 20: Types of received training.

Almost all participants of the different trainings were satisfied with the knowledge and experience of the trainer (94.5%). In Okhaldhunga 98.2% of the participants also trusted the information which was provided to them, in Gorkha this was only 31.3%. The reason for this low number in Gorkha is that in Gorkha there have been a lot different people with information who all told different information, so the people started to doubt which information they should trust.

The people who received training mostly received training about how to build a safe house (59.4%). Followed by how to design earthquake resistant (53.0%), how to choose the right materials (47.5%), how to build earthquake resistant (44.3%), and how to choose a safe place to build (41.4%). The training subjects mentioned before are more often named in Gorkha than Okhaldhunga. In Okhaldhunga people also mentioned, how to use materials (29.7%) and Measurements of the foundation (33.9%) as training subjects. Almost everyone knows that it is useful to receive



training or instruction because 82.1% of the people who did not receive training thinks it is useful to receive. In even 5 wards all people said it is useful to receive training, this means that people are aware that there is more knowledge around.

Figure 21: Received training subjects.

The people who did not receive any kind of assistance, could search or ask for information themselves. From the people who searched themselves, 52.3% did find useful information. Especially in Bakrang (97.8%), Raniban (88.9%) and Singadevi (100%) people find information, but also in 7 wards more than half the people did not find useful information. There is a difference in where people find the information between Gorkha and Okhaldhunga. In Gorkha people find information at a VDC-training, experienced worker or the ward office. In contrast to Okhaldhunga where people find the information mainly somewhere in the neighbourhood, the local contractor or by copying from other houses. The information found in Gorkha is more reliable information because this is mostly found by actual experts, and in Okhaldhunga this is not sure because it not necessary that there are experts around the community.

In Gorkha (70.6%) more people see themselves as experts on earthquake resistant structures than Okhaldhunga (57.9%). Also, more men than women see themselves as experts. Most people learned to build earthquake resistant form experience (44.0%) followed up by participate in a training (30.3%) and participate in the demonstration house (24.3%). The main reasons people do not see themselves as an expert are because they did not take any training (33.8%) or they are too old (25.6%).

## 6.5 Applied techniques

Around 90% of the people applied techniques to construct earthquake or hazard resistant. The most common applied technique is the use of bands. Bands are used by 86.6% of the participants, and some wards this number is even higher; Bunkot (96.1%), Gyalchowk (100.0%), Jantarkani-9 (95.2%), Kijiphalate (98.5%), Lapu (97.9%), Swara (97.4%) and Jantarkani-1 (95.6%). Except for bands there are more



techniques used; the floor is tied to the walls (32.6%), the use of DPC (40.2%), make a bigger foundation (33.4%) and a deeper foundation (44.8%). Some people did not apply techniques to construct earthquake resistant. Their reason is because they do not know how to apply them (69.3%). Especially in Keroja where 97.1% of the people do not know how to apply them. Some other less mentioned reasons are that is too expensive (9.7%) or that they do not need them (8.8%).

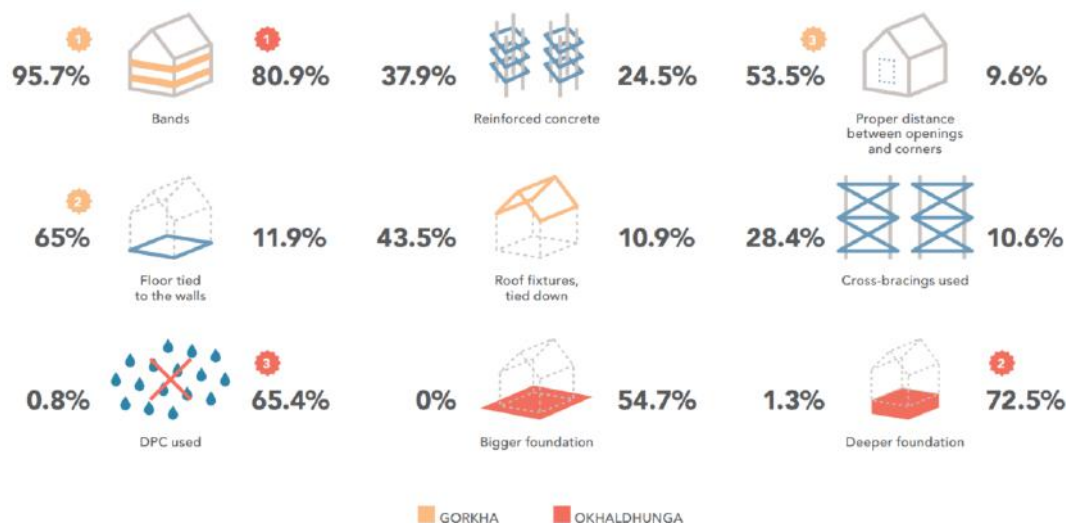


Figure 22: Applied earthquake resistant techniques for both districts.

For almost everyone (97.4%) the explained techniques were different from the way they were used to construct. In 11 of the 24 wards everyone mentioned that the techniques were different. The biggest change in how the people use to build and how they build now is the use of bands (58.2%). Followed up by the foundation (29.9%), use of DPC (16.2%), Use of steel (15.6%), the measurements of the house (15.0%) and use of concrete (13.1%).

Despite that the techniques are very different from what the people are used to, In Gorkha 80.4% of the people will apply earthquake resistant techniques in the future. In Okhaldhunga 63.0% will definitely use them, and 14.0% of the people do not know it yet. Only in Khijichandeshwori 52.8% of the people will not use these techniques in the future. When people will not use the techniques in the future is this because they think they will not need them (67.7%), or they answer that they will never build a house again after this one (19.0%). In Khijichandeshwori the most people will not apply earthquake resistant techniques, their main reason is because they think they do not need them (89.9%).

In Gorkha the question 'What motivates you to apply these techniques in your house?' was asked. The two-main motivators to apply earthquake resistant techniques are to protect their family (40.8%) and to be safer (37.8%). There are other motivators which are less mentioned namely; because they learned how to

apply them (26.5%), if they apply them they can receive the government tranche (22.8%), to prevent that they must reconstruct again (21.5%) and because the government told them to apply the techniques (19.8%). More men (33.2%) than women (17.8%) have learned how to build earthquake resistant.

## 6.6 Construction process

The main barrier what limited the people to start reconstructing, is that they have limited money available (55.2%). In 2 wards almost, all people have limited money available and in 2 wards they did not have this problem. In Gyalchowk 88.7% and Swara 87.0% a lot of people had this problem and in Kalikadevi (12.0%) and Raniban (10.2%) they did not have it. Other reasons were that there were limited materials available (33.2%) and limited masons/ workers (33.5%). In Okhaldhunga around 10% more participants gave these reasons as in Gorkha. In total (13.0%) said that they were not delayed in their reconstruction, they started immediate.

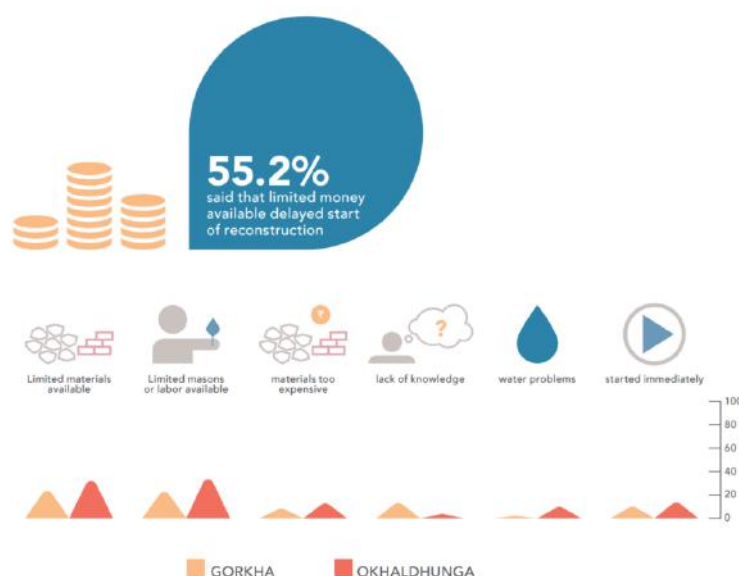


Figure 23: Reasons that delayed the reconstruction.

The main reason what limited the people in their construction speed was the lack of money (56.1%) followed by the lack of materials (40.4%) and the lack of masons/ labourers (36.9%). In Gorkha the participant also mentioned that they had difficulties with transport (16.2%) and lack of knowledge delayed them (12.0%). Especially in Bhussinga (92.2%), Gyalchowk (82.1%) and Swara (86.0%) were the lack of money was really delaying their progress.

The main problem people had that affected the quality of their building is lack of money (52.5%). The second biggest reason in Okhaldhunga is limited masons



available, 20.7% in Gorkha and 31.6% in Okhaldhunga. The third problem in Okhaldhunga is limited materials available, in Gorkha 14.4% and Okhaldhunga 33.1%. In Gorkha their second main problem is that they had difficulties with material transport (22.8%) and materials were too expensive (21.1%).

Figure 24: Reasons that affected the quality of constructions.

Concluded from the results above can be that; the lack of money, limited mason/workers available and limited materials available are the main barriers in the reconstruction process of the people. As well when they started, as the speed, the quality.

## 6.7 Awareness

It is important to see if people are aware of how they should build, what is safe and what is strong. The participants most given reason to know their house is strong is that they applied earthquake resistant principles (39.2%). Especially in Gorkha where 61.5% used them. In Bakrang, Fulbari, Gyalchowk and Lapu even more than 80.0% applied earthquake resistant techniques. Visible in the gender difference is that 43.3% of the men said they used the principles and only 34.0% of the women did. Other ways how people know their house is strong, is when an engineer has told them (25.3%) or they know they have used strong materials themselves (21.5%). In Okhaldhunga people also know it because they have made a strong foundation (24.0%). In Okhaldhunga 17.5% of the participants mentioned that their house is not strong at all.

In Gorkha almost everyone feels their house is safe in case of small earthquake (96.54%). In Okhaldhunga this number is a little bit lower namely 82.6%. In 5 wards even, everyone thinks their house is safe in case of an earthquake (Aaruarbang, Bakrang, Gyalchowk, Lapu and Ragani). Only in Harkapur 47.7% and Tulachap 38.7% feel their house is safe, that means that more than half the people feel think it is not safe in case of a small earthquake. In case of a big earthquake 53.7% of the people feel their house is safe. Especially in Bakrang, Gyalchowk and Jantarkani-1

where more than 85% of the people feel their house is safe. Only in Kalikadevi and Keroja more than 80% of the people do feel safe when a small earthquake come but not when a big earthquake hit.

When people think their house is not safe in case of a big or small earthquake the reason for that is, that the walls are not strong enough (16.3%). In Okhaldhunga 9.3% of the people are not sure about every part of their house. But overall most people think that all parts are strong enough (62.3%). The reason these parts are not strong enough is different between the two districts. In Gorkha the reasons are the use of weak materials (21.7%), the use of dry stone (16.9%), use of mud for the wall (15.7%) and because they did not use cement or concrete (15.7%). In contrast to Okhaldhunga were the reasons were that the roof was too thin (11.9%), the wall is too high (14.3%), the house is next to a slope (13.5%), the use of mud for the walls (28.6%). A lot of women did not know why the parts are not strong enough (27.0%).

## 6.8 Priorities

A lot of people could make their house safer but are not able to do it. In Gorkha 83.1% could still make their current house safer, but only 34.3% is able to do that. The rest of the people does not have the resources to do that. In Okhaldhunga this number is 61.9% and 43.7% is also able to make their house safer. So, the number of people who can make their house safer is in Okhaldhunga higher than in Gorkha, around 10% more.

If people had more money they would use it, in both districts, for their house (25.5%) and for education (17.6%). In Gorkha people would also use it for food (43.1%), to buy animals (27.0%), improve the location (19.1%) and they would save some money (21.2%). In Okhaldhunga people would also use it for food (9.6%) but also daily needs (15.2%), to pay their loan (16.6%) and invest in a business (13.6%) and 14.2% would build another house.

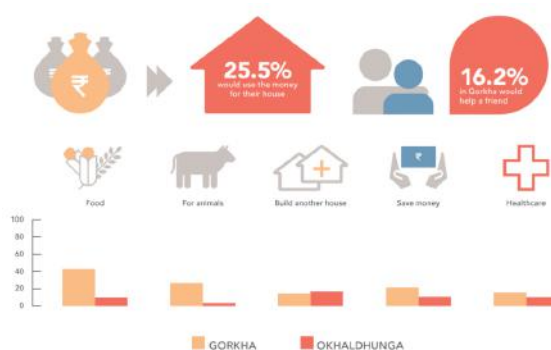


Figure 25: Usage of money if people would have more money.

If people must build a house again they mostly would do some things different. In Gorkha district and Okhaldhunga district most of the people would ask for more advice. In Gorkha this number is 31.6% and in Okhaldhunga 45.3%. In Gorkha the people would also change the design of the house (32.4%) and the material choice

(34.3%), while in Okhaldhunga only 13.3% and 10.5% would do that. It seems like in Okhaldhunga people are less aware of what is wrong with the way they build. Because, 11.8% just answers that they will build it stronger and do not say what parts they will make stronger. However, most people will change things, 17.4% of the people will not.

## 6.9 Financial assistance

The main occupation source for both districts is agriculture, for 79,9% of the people this is the main source of income. More women (88.4%) than men (73.3%) work in this sector. All people in Kaptiguna-8, Kaptiguna-2 and Khijichandeshwori work in agriculture. The second source of income is mason or carpenter for 18.9% of the participants this is the main source of income. More men (24.7%) than women (11.6%) are working in this sector.

With the income from agriculture or as mason or carpenter, most of the people do not earn enough money to pay for their reconstruction. The Government tranches (69.8%) are the biggest source of money for the reconstruction. Especially in Bakrang, Fulbari, Ratmate, Singadevi and Swara, in all these wards more than 90% of the people used the government tranche to get money for their reconstruction. The second source of money is taking a loan, in Gorkha 61.0% take a loan and in Okhaldhunga this is 44.8%. In Gorkha more people used their own savings (50.3%) to reconstruct their house, in Okhaldhunga this was only 23.5%. It could be that less people had savings in Okhaldhunga than in Gorkha.

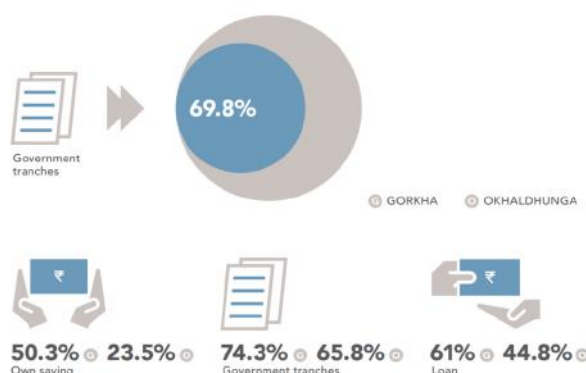


Figure 26: Financial resources for the reconstruction.

The biggest source of income for the participants to reconstruct their house was the governmental tranche. Almost everyone applied for them, 94.0% of the people did. In Bakrang, Fulbari, Kalikadevi and Tulachap everyone applied for it. There is one exception, Kaptiguna-8, where only 63.6% applied. Almost everyone who applied for the government tranches already received the first one (95.8%). In Fulbari, Gyalchowk, Khijichandeshwori and Ratmate everyone received the first tranche.

## 6.10 Future

In Gorkha 56.5% of the participants are planning to make changes on their house. In Okhaldhunga this is 27.8%, but also 35.2% of the people do not know yet if they will make changes. This is probably because a lot of people have just started. In Gorkha the question what people would change was asked. The main improvement people want to make on their house is, to make it earthquake resistant (41.0%). In Keroja even more people will do that (89.0%). The other improvements are about a bigger house, add an extra floor (24.1%), add extra rooms (39.0%). The difference between men and women is, that more men (14.5%) than women (6.3%) will make an extension at their house.

In Gorkha 55.1% of the people would use the same materials in the future as they used now. This contrasts with Okhaldhunga where 33.7% is sure they will do that and 40.1% do not know it yet. The reason for this is that the completion rate in Gorkha is higher than Okhaldhunga. In Okhaldhunga people are still working at their house, and not thinking about improvements. The people who will not use the same materials are going to use concrete, steel or cement. The main material change in Gorkha would be that they are going to use cement (25.7%), and in Okhaldhunga this is the same (54.3%). In Okhaldhunga mentioned 66.7% of the people that they will change the material source but ask for advice what materials to use.

The main reason people will not use the same materials is because they are too weak (95.2%). In Okhaldhunga this number is a bit lower, there 79.4% mentioned the materials are too weak. In Okhaldhunga also 13.9% of the people mentioned that they will use other materials because the current materials are too hard to get.

In the future people could use the same techniques or change from technique. In Gorkha 52.1% of the people will use the same techniques and in Okhaldhunga this is 40.8%. In Okhaldhunga still 40.5% of the people do not know yet if they are going to use the same materials or not. Again, this is because the completion rate is much lower in Okhaldhunga than Gorkha. The people who will not use the same techniques will not do this because the techniques they have used right now are not safe enough. In Gorkha this number is 80.8% and

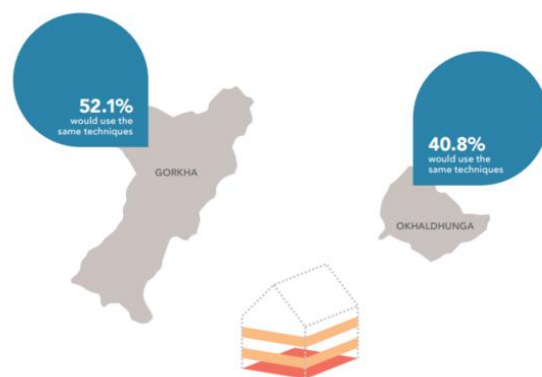


Figure 27: Would people use the same materials.



in Okhaldhunga 70.2%, but in Okhaldhunga 25.4% would also change it to be safer in the future and they want to use more advance techniques (14.9%).

## RQ5. The expected level of motivation, ability and opportunity for different districts, communities and genders.

In this chapter the question *“What is the expected level of motivation, ability and opportunity for different districts, communities based on the found characteristics?”* is answered.

In this chapter the level of motivation, ability, opportunity and trust is described based on the results from RQ4. For each topic the different results are concluded and evaluated, also some recommendations to improve the adoption of knowledge are described and improvements for the survey.

In RQ2 is described how the level of motivation, ability, opportunity and trust could be measured by counting the amount of positive and negative answers, and make a scale to see if the levels are high or low. This method is not tested in this thesis because of the lack of time. However the expected level of motivation, ability and opportunity is described in this thesis. So in an follow-up study in which this method can be tested the results can be compared with each other to see if they have the same outcome.

### 7.1 Motivation

#### Results of level of motivation

- The adoption of knowledge has found to be high since techniques are applied to construct earthquake resistant (88.9%). In terms of bands (86.6%), floor wall connection (32.6%), bigger (33.4%) and deeper (44.8%) foundation and proper distance between openings (in Gorkha 53.5%).
- Construction professionals show interest to learn more and apply new knowledge. The participants are highly motivated to search for information and find sources of information (86.2%). Even Though the explained techniques are different than the way people are used to construct (97.4%), people are highly willing to apply the techniques (70.5%). In Keroja 60.2% of the participants did not apply earthquake resistant techniques. The results from the interviews with important people when it comes to reconstruction (according to the villagers), shows that they show interest to learn more and apply new knowledge.
- The main motivator to construct safer, is to be safe in general and protect their family. In Gorkha 56.5% and Okhaldhunga 27.8% of the households are

planning to make improvements to their house. The main improvement they want to make at their house is add earthquake resistant principles (41.0%). In the future 45% of the people will even use the same techniques as they used now, some people would not use the same techniques but that is mostly because the techniques they used now are not safe enough (76.9%). All off these motivators shows that their motivation to be safer is high.

- Financial support is the most important motivator and barrier for the application of hazard-resistant construction principles. The government tranche is the biggest source of money for the construction of housing (69.8%). It is expected that when government funding is not provided, people will save on the quality of their construction. The motivation of spending money on their house (25.5%) is not very high, they often also use it for education (17.6%), food (23.15%) and animals (12.9%). Therefore it is not expected that priority will be given to the house.

Overall in both districts Gorkha and Okhaldhunga the level of motivation is expected to be high. Because almost everyone is motivated to apply earthquake resistant techniques, and are highly willing to receive information to build back safer housing. people are motivated to apply the explained techniques even though the explained are very different than the way people are used to construct, only in Keroja a lot of people did not apply the techniques. Both genders men and women are motivated to apply earthquake resistant techniques and both want to improve their situation of living.

#### **Recommendation to increase the level of motivation.**

- A recommendation to NGOs, INGOs and all countries who face with natural disasters. Try to motivate people with money or materials to build back safer housing or make sure they apply hazard resistant techniques. By letting the people apply the provided knowledge it is more likely that they will share their knowledge with others and apply it in the future.
- The governmental tranche procedure is a good stimulants for people to apply earthquake resistant techniques. However the design people have to build if they want to receive the tranche often do not fit the family needs. It is recommended to try to make the design a bit more flexible so people can adjust the design to their needs to increase the likeliness that they will apply for the tranche.

## 7.2 Ability

### Results of level of ability

- From the damaged houses most of the people already started with the reconstruction of their house. In Gorkha district 89.8% already started and in Okhaldhunga 78.1% has started.
- Overall the ability to name and replicate earthquake resistant construction principles has found to be high.
- The percentage of received training is almost the same in Gorkha (60.6%) and Okhaldhunga (54.9%). These are remarkable results, because according to the HRRP dataset there have been given more training in Gorkha than Okhaldhunga district. In Okhaldhunga 57.0% of the people mentioned that their mason participated in some sort of training, which could explain the high number of received training in Okhaldhunga.
- However, more efforts have been invested in Gorkha. It appears that little technical assistance leads to better results than a lot of technical assistance, because in Okhaldhunga they only received little assistance and they are also able to apply new techniques.
- The people who received training mostly received training about how to build a safe house (59.4%). Followed by how to design earthquake resistant (53.0%), how to choose the right materials (47.5%), how to build earthquake resistant (44.3%), and how to choose a safe place to build (41.4%). The training subjects mentioned by the participants are mostly mentioned in Gorkha district. In Okhaldhunga people also mentioned, how to use materials (29.7%) and measurements of the foundation (33.9%) as training subjects. In Gorkha people mentioned more training subject on how to build earthquake resistant while in Okhaldhunga a lot of people mentioned how to build in general.
- Financial support is the most important motivator and barrier for the application of hazard-resistant construction principles. The government tranche (69.8%) is the biggest source of money for the construction of housing followed by taking a loan (52.4%) and own savings (36.1%). All of these sources of money will increase the ability to build back safer housing. Limited financial resources (52.2%) often results in less construction quality.
- Because of the tranche procedure, the reconstruction depends on the knowledge of temporary assigned engineers. They have found to be the main knowledge source. Right now these engineers are of positive influence on the ability but could be of negative influence in the future.
- Level of understanding is insufficient to create alternative designs. As the satisfaction about the government recommended designs is currently low, the

low level of understanding might lead to more unsafe structures. Low level of understanding by community based construction professionals, limited to replication of designs recommended by the government, is expected to cause problems in the future when alternative designs are asked for.

- The downside of the tranche process is that it slows down the reconstruction because of the bureaucratic, complex and opaque tranche application process. Also some groups are left behind. People waited for governmental tranche before they started with the reconstruction of their house.
- The main reason people are delayed in the start of there construction process is because of a lack of money (56.1%), no materials available (40.4%) and limited availability of masons (36.9%). The main reason what limited the people in their construction speed was the lack of money (56.1%) followed by the lack of materials (40.4%) and the lack of masons/ labourers (36.9%). In Gorkha the participant also mentioned that they had difficulties with transport (16.2%) and lack of knowledge delayed them (12.0%). The difficulties with transport can be explained by comparing this with the general ward data. None of the communities are accessible by normal road they are only accessible by unpaved road or sometimes only by foot.
- People are aware of the risk and feel quite save. Most people in the new houses feel safe in case of an earthquake (87.8%).
- In Okhaldhunga district the participants mostly told that they copy “how to make a strong foundation” (24.0%). This is an understandable answers because most houses in Okhaldhunga are still only at foundation level, which is also visible out of the results from the structural assessment. Out of the results is expected that the reason houses in Okhaldhunga are only at foundation level is that, the people waited with the reconstruction until they received some type of advice or training. This advice and training came much later in Okhaldhunga because the Government of Nepal and NGOs started in the most affected area.

Overall the ability to build back a safer house has found to be basic. Based on Bloom’s taxonomy the people are able to remember and understand the provided knowledge, and they can apply/ replicate earthquake resistant principles, see RQ2.

Different technical assistance typologies did increase the level of understanding of earthquake resistant construction principles. The level of understanding in Gorkha is higher than Okhaldhunga. In Gorkha people have a more technical reasoning why their house was destroyed in comparison with Okhaldhunga where the most given reason was *‘the earthquake’*. The provided training is different between Gorkha and Okhaldhunga. In Gorkha there have been given more technical training while in Okhaldhunga training subjects like *‘how to build in general’* are provided. The lack of

available money, materials and masons/carpenters did decrease the level of ability and the quality of the houses as well.

### **Recommendation to increase the level of ability.**

- The main recommendation to increase the level of ability is to provide more materials and money. This is easier said than done so a better recommendation would be to improve the provided construction principles by implementing the available materials in the design. This way everyone would be more able to apply the proved knowledge.
- Make the remote communities more accessible. This way people are more able to get better quality materials who can not be found in the direct area. For example people can use concrete for their house because they do not have to carry heavy bags for an hour or so.
- To increase the level of ability it is recommended to provide everyone with knowledge. Right now there are temporary trained people available who provide people with knowledge. It is expected that, the people who receive information will not remember it if it not repeated more often. So the advice is to keep repeating the information and organise more meetings and discussions groups.



*Figure 28: Focus group discussion one for men and one for women.*

## **7.3 Opportunity**

### **Results of level of opportunity**

- In Gorkha (83.1%) more people think they can still make their house stronger than in Okhaldhunga (62.0%). The awareness of the possible improvements of structural safety indicates an understanding of their mistakes.
- Communication of hazard-resistant construction principles mainly aimed for replication only and did not allow differentiation. This is of negative influence on the opportunity to build back safer because if the design does not fit the needs of the people they are not able to change the design.



- The opportunity to choose a safe location of the house is low, 47.8% did not have other options for the location. However people do think about a safe location for their house.
- Radio (25.4%), door-to-door (27.0%) and engineers advice (27.0%) are named as the most reliable sources of information, and the best way to receive the information is also by radio (28.0%), door-to-door (face to face) (61.1%) and via demonstration house (22.2%).
- The main reason for both, men and women, why they did not make a plan, was because it was already done by the people who were going to build their house (53.1%). In Gorkha this was 71.6% of the participants and Okhaldhunga 32.9%. Another reason was that there was no technical support available (17.8%)
- The main problem people had that affected the quality of their building is lack of money (52.5%). The second biggest reason in Okhaldhunga is limited masons available, 20.7% in Gorkha and 31.6% in Okhaldhunga. The third problem in Okhaldhunga is limited materials available, in Gorkha 14.4% and Okhaldhunga 33.1%. In Gorkha their second main problem is that they had difficulties with material transport (22.8%) and materials were too expensive (21.1%).
- If people must build a house again they mostly would do some things different. In Gorkha district and Okhaldhunga district most of the people would ask for more advice. In Gorkha this number is 31.6% and in Okhaldhunga 45.3%. In Gorkha the people would also change the design of the house (32.4%) and the material choice (34.3%), while in Okhaldhunga only 13.3% and 10.5% would do that. It seems like in Okhaldhunga people are less aware of what is wrong with the way they build. Because, 11.8% just answers that they will build it stronger and do not say what parts they will make stronger. However, most people will change things, 17.4% of the people will not.

The level of opportunity is high for some topics and low for others. The level of opportunity is low for the location of the house and the accessibility of the communities. Especially in Keroja and Jantarkani-9 where the accessibility is so low people often can not get materials who does not come from the area. The provided knowledge is mainly aimed for replication only, this is of negative influence for the future because people can not adopt this knowledge. The opportunity to receive information is high, there is information on how to build back safer available, but a lot of people do not know how or where to search for it or did not receive information.

#### **Recommendation to increase the level of opportunity.**

- To increase the level of adoption, the information can best be presented by radio, door-to-door (face-to-face), demonstration house, these methods are named as the most reliable and trusted.

- Regarding the location of the house people do often not have other options. A recommendation to the government of Nepal is to increase the accessibility of the remote communities.

## 7.4 Trust

### Results of level of opportunity

- Technical assistance typologies appeared to be of negative influence on the directly earthquake resistance of housing. Independent application of hazard-resistant construction principles is higher even when limited technical assistance has been given (93.9% against 82.2%). This might be related to the fact that when people are provided with more information they show to have more doubts. In the area with less technical assistance people do not have much doubt about the provided information (1.8% against 68.7% who had doubts). During the surveys in Gorkha people mentioned to have doubts about the information because, lots of different things were told to them. They meant that person 1 could say something completely different than person 2 while they were asked the same question. In Okhaldhunga this is mentioned way less because in a lot of cases they only received information from 1 or 2 persons.
- In Okhaldhunga most of the people (98.2%) have trust in the provided knowledge, in contrast to Gorkha where only 31.3% has trust in the provided knowledge. The main reason people trusted the knowledge was because the sender was a trained person or knows how to build a house.

The level of trust is divided between the two districts. In Okhaldhunga the level of trust is higher than in Gorkha. This is because in Gorkha people were provided with information from all NGOs but the NGO did not always tell the same information, because of this people show to have more doubts about the information and the trust in the trainer. In Okhaldhunga this is different, there the people received information from less NGOs and the provided information was more of the same. This is why the trust in Okhaldhunga is higher than Gorkha.

### Recommendations to improve the level of trust

- This is a recommendation to all NGOs, INGOs and the Nepal government. The survey shows and the participants mentioned that provided knowledge has to be the same at all time. With this is meant that everyone who provides the people with knowledge must provide the same knowledge, not exactly the same but the way to build a house must be the same.

## 7.5 Improvements for the survey

- The question "Did you or the person who build your house receive any training or instruction?", this question partly shows incorrect answers. Because you might think that a lot of people received training why instead one mason build all houses. So it is better to, split up the questions in the future to "Did you receive any training or instruction?" and "Did the person who build your house receive any training or instruction?".
- To measure the level of motivation it would be a good idea to let the participants answers in a scale. For example a scale from 1 to 10, where 1 is very unmotivated and 10 is very motivated. There can be added multiple question about different parts of motivation which can be answered in a scale. This way the interpreter does not have to interpret the level of motivation.
- Questions related to the participants occupation are included in the survey, but not the households income. It is interesting to compare decisions from the participants with their income. For example does people use more hazard resistant construction principles when earning more money. Or do people who earn a lot of money compared with others, also apply for the governmental tranche or not.
- In the questionnaire the remoteness is excluded. It is better to add the remoteness in the survey in two forms. The first one is the real remoteness en accessibility. So what is the distance, traveltime and type of road to the nearest city. The second form is the participants view of remoteness. So does the participant find any limitation due to the remoteness.

## Conclusion

The main question for this research is:

*What is the likeliness of adoption taking place based on motivation, ability and opportunity in processes of self-recovery and aided self-recovery and how can the likeliness be increased?*

By using the collected data from the household survey from this research, the following conclusions have been drawn.

Measuring the motivation, ability, opportunity and trust to determine the likeliness of adoption taken place has found to be a good way of measuring. By implementing the MAO-model and trust in the questionnaire it was much easier to find the drivers and barriers. By using the MAO-model it was possible to specify the needs by one of the four aspects. By knowing the main drivers it is possible to say what the likeliness of adoption taken place is. By knowing the barriers it is possible to give a recommendation to increase the likeliness of adoption. The following main drivers and barriers were found using the results from the household survey.

### Drivers

- Overall the ability to name and replicate earthquake resistant construction principles has been found to be high.
- The adoption of knowledge **has found** to be high since techniques are applied to construct earthquake resistant (88.9%). In terms of bands (86.6%), floor wall connection (32.6%), bigger (33.4%) and deeper (44.8%) foundation and proper distance between openings (in Gorkha 53.5%).
- The percentage of received training is almost the same in Gorkha (60.6%) and Okhaldhunga (54.9%). And the people who did not receive information do think it is useful to receive (82.1%). However, more efforts have been invested in Gorkha. It appears that little technical assistance leads to better results than a lot of technical assistance, because when people receive a lot of assistance (Gorkha) they show to have more doubts than when people did not receive much assistance (Okhaldhunga). While in Okhaldhunga 93.9% of the people applied earthquake resistant techniques against 82.2% in Gorkha.
- Technical assistance typologies did increase the level of understanding of earthquake resistant construction principles. The level of understanding in Gorkha is higher than Okhaldhunga.
- Financial support is the most important motivator and barrier for the application of hazard-resistant construction principles. The government tranche (69.8%) is the biggest source of money for the construction of housing followed by taking a loan (52.4%) and own savings (36.1%). Limited

financial resources (52.2%) often results in less construction quality. It is expected that when government funding is not provided, people will save on the quality of their construction. The motivation of spending money on their house (25.5%) is not very high, they often also use it for education (17.6%), food (23.15%) and animals (12.9%). Therefore it is expected that people do not have a very high priority on building back a safer house and have their priorities somewhere else, but build back a safer house now because of the availability of money because of the governmental tranche.

- If people did not apply earthquake resistant techniques this was mainly due to a lack of understanding of how to apply techniques (69.3%), and only 9.65% mentioned financial resources. This low percentage of financial barrier could be because 94% of the participants applied for the governmental tranches. Construction professionals show interest to learn more and apply new knowledge, they have a high motivation to search for information and find sources (86.2%). Even Though the explained techniques are different than the way people are used to construct (97.4%), people are highly willing to apply the techniques (70.5%). People are motivated to construct safer, to be safe in general and protect their family. In Gorkha 56.5% and Okhaldhunga 27.8% of the households are planning to make improvements to their house, this shows that the people are motivated to improve their situation of living. 41.0% of the people who are planning to make improvements on their house wants to make earthquake resistant improvements.
- More than half the people (57.9%) consider themselves as experienced on earthquake resistant constructions, which indicates a high self-efficacy. Compared with those peoples houses they show to have the knowledge to build earthquake resistant, almost all houses contain earthquake resistant principles. Important to note is that trainers from NGOs show to be more experienced than most participants who consider them self as experienced.
- People are aware of the risk and feel quite safe. Most people (87.8%) in the new houses feel safe in case of an earthquake.
- Radio (25.4%), door-to-door (27.0%) and engineers advice (27.0%) are the most reliable sources of information, and the best way to receive the information is also by radio (28.0%), door-to-door (face to face) (61.1%) and via demonstration house (22.2%).
- People are satisfied with the knowledge and experience of the trainer (94.5%). The trainer indicates the person who provided the participant with knowledge and information. The provided information was mainly about how to build a safe house (59.4%), how to design earthquake resistant (53.0%) , what is a safe location for you house (41.4%) and what are the right materials (47.5%).

- In Okhaldhunga district lots of houses are only at foundation level, this is mainly because people waited with their reconstruction until they received some advice and the governmental tranche. This indicates they are very motivated to receive advice and adopt the provided knowledge.

### **Barriers**

- Financial support is the most important motivator and barrier for the application of hazard-resistant construction principles. The government tranche (69.8%) is the biggest source of money for the construction of housing followed by taking a loan (52.4%) and own savings (36.1%). Limited financial resources (52.2%) often results in less construction quality. It is expected that when government funding is not provided, people will save on the quality of their construction. The motivation of spending money on their house (25.5%) is not very high, they often also use it for education (17.6%), food (23.15%) and animals (12.9%). Therefore it is not expected that priority will be given to the house.
- Because of the tranche procedure, the reconstruction depends on the knowledge of temporary assigned engineers. They have found to be the main knowledge source. People trust in the provided knowledge (77.5%) because the sender was a trained person or knows how to build a house. This trust and dependency might harm application in the future and is a disadvantage for community resilience.
- Communication of hazard-resistant construction principles mainly aimed for replication only and did not allow differentiation. With this is meant that people only receive information about one particular design, mainly the design people have to apply to receive the governmental tranche. The information is so little that people are not able to develop the knowledge to make a different design.
- Technical assistance typologies appeared to be of negative influence on the directly earthquake resistance of housing. Independent application of hazard-resistant construction principles is higher even when limited technical assistance has been given (93.9% against 82.2%). This might be related to the fact that when people are provided with more information and show to have more doubts. In the area with less technical assistance people do not have much doubts about the provided information (1.8% against 68.7% who had doubts).
- The level of understanding is insufficient to create alternative designs. As the satisfaction about the government recommended designs is currently low, the low level of understanding might lead to more unsafe structures. Low level of understanding by community based construction professionals, limited to



replication of designs recommended by the government, is expected to cause problems in the future when alternative designs are asked for.

- The main delay in the construction process is because of a lack of money (56.1%), no materials available (40.4%) and limited availability of masons (36.9%). The barrier of materials is mainly because the remoteness of communities and materials are too expensive to use. The barriers of masons is mainly because the lack of knowledge in the communities. If more community members would have the knowledge to build earthquake resistant they could become good masons and help others.
- A downside of the tranche process is that it slows down the reconstruction because of the bureaucratic, complex and opaque tranche application process. Also some groups are left behind. People waited for governmental tranche before they started with the reconstruction of their house.
- A lot of people have a low opportunity for a safe location of their house, 47.8% did not have other options for the location. However people do think about a safe location for their house, because if people had the opportunity to change from location they choose for their location because an engineer told them to.

Overall the likeliness of adoption taken place has found to be high, mainly because of the high motivation people have to build back earthquake resistant housing. The availability of the governmental tranches increase the ability and motivation of the people. because of the tranches people must build their house following some guidelines to build back safer, and this way they learn how to apply the techniques. In general people have much trust in the provided knowledge and the trainer, this also increases the likeliness of adoption. The best way to provide people with knowledge is via radio, door-to-door (face-to-face) or demonstration house. However people do face some barriers regarding the likeliness of adoption taken place. The main barrier is that people do not have enough money to apply the provided knowledge and when people can not directly use the knowledge it is very likely that they will forget it. Another barrier people face is that they sometimes receive lots of different advices. Limited financial resources (52.2%) often results in less construction quality. specially in Gorkha district where more than 25 NGOs or INGOs were involved. Many NGOs spreaded different information and people started to have doubts which information they should apply and which not.

## Recommendations

### **Increase the likeliness of adoption**

The following improvement to increase the likeliness of adoption taken place are recommended:

- This is a recommendation to all NGOs, INGOs and the Nepal government. The survey has shown and the participants mentioned that provided knowledge has to be the same at all time. With this is meant that everyone who provides the people with knowledge must provide the same knowledge at community level. If not it is expected to cause confusion and less trust in the shared knowledge.
- A recommendation to NGOs, INGOs and all countries who face with natural disasters. Try to motivate people with tranches or materials to build back safer housing or make sure they apply hazard resistant techniques. By letting the people apply the provided knowledge it is more likely that they will share their knowledge and apply it in the future.
- The governmental tranche procedure is a good stimulance for people to apply earthquake resistant techniques. However the design people have to build if they want to receive the tranche often do not fit the family needs. It is recommended to make the design more flexible so people can adjust the design to their needs to increase the likeliness that they will apply for the tranche.

### **Improvements household survey**

The following improvements of the survey are recommended:

- The question "Did you or the person who build your house receive any training or instruction?", this question partly shows incorrect answers. Because you might think that a lot of people received training why instead one mason build all houses. So it is better to, split up the questions in the future to "Did you receive any training or instruction?" and "Did the person who build your house receive any training or instruction?".
- To measure the level of motivation and trust it would be a good idea to let the participants answers in a scale. For example a scale from 1 to 10, where 1 is very unmotivated and 10 is very motivated. There can be added multiple question about different parts of motivation and trust which can be answered

in a scale. This way the interpreter does not have to interpret the level of motivation.

- Questions related to the participants occupation are included in the survey, but not the households income. It is interesting to compare decisions from the participants with their income.
- In the questionnaire the remoteness is excluded. It is better to add the remoteness in the survey in two forms. The first one is the real remoteness en accessibility. So what is the distance, traveltime and type of road to the nearest city. The second form is the participants view of remoteness. So does the participant find any limitation due to the remoteness.

### **Follow-up studies**

For a follow-up study the following studies are recommended to make.


- Measure the level of motivation, ability, opportunity and trust by using the developed measurement scale form this thesis.
- Compare the outcomes from the measurement from the level of motivation, ability, opportunity and trust with the level of motivation, ability, opportunity and trust described in this thesis.
- Make a deeper analysis by triangulating the outcomes from the household survey with the outcomes from the structural assessment and Focus group discussion.
- Identify what groups can be identified based on motivation, ability, opportunity and trust, described in RQ2.
- Identify what strategy would be appropriate to support the different groups to build back earthquake resistant.

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## Appendix

1. Question distribution table of MAO-model and trust
2. General ward data
3. Improvements from questionnaire Philippines to first draft
4. First draft questionnaire Nepal
5. Second draft questionnaire Nepal
6. Improvements from first draft to second draft questionnaire Nepal
7. Gorkha questionnaire
8. Improvements from second draft to Gorkha questionnaire
9. Okhaldhunga questionnaire
10. Improvements from Gorkha to Okhaldhunga questionnaire
11. Mutations in the raw dataset
12. Frequencies from gathered data