Knowledge Exchange during Self-Recovery in Nepal

Bouwtechnische Bedrijfskunde

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'Picture 1, Construction Site in Lapu, Gorkha'

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The research is executed within a research team. This team is formed with:

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

Preface

This graduation thesis '*Knowledge exchange during self-recovery in Nepal*' is the last assignment of the four year bachelor of construction management and engineering at Avans University of Applied Sciences. I thank teachers and other students for their support during my studies. I am also grateful for the internships and a minor that were part of this study program. I've learned a lot about the construction management industry.

During the minor of 2017, I came in contact with Eefje Hendriks. Eefje is a PhD candidate who is working on a research about knowledge exchange after a natural disaster. After a conversation with her I decided that I wanted to help during such a field research. I choose to join her for a research in Nepal because I was curious how projects are managed after a natural disaster in a developing country. I also wanted to know how people decide to use certain technical knowledge in their construction process. I feel passionate to contribute to effective ways of reconstructing safe housing after a natural disaster. This research is a result of an intensive research period of 3 months in Nepal in close collaboration with fellow graduation students inside a research team and together with an non governmental organisation. The experience in Nepal has been unforgettable in many ways. In this thesis, I would like to share the findings that were under my responsibility.

First of all, I would like to thank all of the people from the research team that helped me before, during and after the field research, Eefje Hendriks, Laura Howlett, Benjamin Schep, Jim de Kort, Sandra van Ekeren, Gijs van Duren. I am grateful for the research participants, Milan Mukhia, Hari Devkota, Khitiz Pokhrel, Pravesh Khanal and Lumanti Joshi that openly shared their thoughts with me and enabled me to make this research valuable. I am thankful for the financial contribution for the field research activities made by Avans University of Applied Sciences and Catholic Relief Services. I also would like to thank my supervisor Michiel Smiths and second supervisor Joost Evers for his input and feedback during the writing of this thesis.

Ospel, 13 june 2018

Abstract

Previous research has concluded that currently humanitarian organisations are not communicating their knowledge effectively to communities and they have a lack of insight in existing knowledge exchange strategies to improve the adaptation of knowledge in communities.

The purpose of this study was to find recommendations for the communication between humanitarian organisations and households that enable adoption of hazard resistant construction knowledge by households that reconstruct their own house after the earthquake in Nepal. This study gives insight in which elements of knowledge exchange programs has proven to lead to adoption of knowledge in communities for self-recovery.

An extensive literature review, 6 expert interviews, a case study and a comparative field study have been conducted to increase. Based on these studies it is recommended that it is expected to be crucial to organise meetings in a sequence after the first introduction to enable learners to assist each other in the application of the knowledge. It is recommended to exchange knowledge instead of purely transferring knowledge in order to enable a lasting understanding and adoption. It is also recommended that knowledge interventions should use a lot of practical examples and have a short presentation with simple information and the masons should be supported on the construction site in order to successfully enable adoption. Sharing knowledge is especially effective when the knowledge is shared face to face or by a community meeting or through the radio or with the use of a TV.

These findings support the notion that communication between humanitarian organisations and communities could be more effective to improve the adaptation of knowledge.

For further research a longitudinal study is recommended to measure the lasting effect of knowledge interventions. Further research is recommended to use this thesis as a basis for a follow-up field study to test the recommendations. As part of this study preparations have been made for a longitudinal study however, due to practical limitations, this study could not be conducted as part of this thesis.

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1.0 Introduction

This introduction is part of the research proposal written by the research team consisting of Eefje Hendriks, Laura Howlett, Benjamin Schep, Ranon Caris, Sandra van Ekeren, Jim de Kort and Gijs van Duren.

1.1 Problem description

Nepal was hit by an earthquake in April 2015. In the reconstruction program, humanitarian organizations aim to broaden the application of hazard-resistant construction techniques on a larger scale, to reduce vulnerability in case of recurring disasters (Joshi, L., 2018). Most of the training is provided by humanitarian organisations and the application of this knowledge is enforced by the Nepalese government. Money is provided in tranches only when people follow the approved guidelines (Mukhia, M., 2018). There is a catalogue of designs available with plans and technical alternatives (Mukhia, M., 2018).

However, it is difficult for communities to prioritize these guidelines and translate them to their own situation. Training is supposed to be given in all communities however people are still waiting in some cases and have started without training. They take a large risk, because in some municipalities people are cut off from water and electricity when they do not follow the guidelines. Others wait for training to be provided and this slows down the recovery process (Hendriks, E., 2017 Dec).

The recovery process also raises the question if people are reconstructing with the main motivating factor being the compliance to the government design and the extent of application of techniques and practices being internalised. Once completed, there is little incentive to build in a particular way, they may return to unsafe practices for repair/extension/relocation, potentially compromising in safety. Currently, humanitarian organisations are not communicating their knowledge effectively to communities and they have a lack of insight in existing knowledge exchange strategies to improve the adaptation of knowledge in communities (Hendriks, E., 2017 Dec).

It is important to increase the adoption of techniques to build back safer in order to make communities more resilient in case of another disaster (Hendriks, E., 2017 Dec). There is a need for more understanding of what could increase the effectivity of knowledge exchange strategies. Currently, there is limited documentation about what learning strategies could be applied in knowledge interventions. Besides from that, there are no documented insights from experts that could increase an effective application in practice. Besides from that, there are opportunities to enlarge the understanding by analysing a case study. Next to that, field research could increase the understanding of why people decide to apply technical guidelines or not to apply it. This graduation research, aims to bridge this gap.

1.2 Research goals and objectives

This research evaluates the experiences and opinions of experts, Lumanti's way of working, literature and the outcome of the surveys, focus group discussions and the structural assessments which are held in Gorkha and Okhaldhunga in the communication that enable adoption of hazard resistant construction knowledge by households that reconstruct their own house after the earthquake in Nepal. This research gives insight in which elements of knowledge exchange programs has proven to lead to adoption of knowledge in communities for self-recovery.

The objectives of this research are:

1. To get an insight on which theory models are effective in the support of self-recovery and enable a lasting understanding of hazard-resistant construction principles.
2. To get an insight based on the experiences and opinions of experts about an effective support of self-recovery and enable a lasting understanding of hazard-resistant construction principles.
3. To get an insight on what existing knowledge at NGOs is already been used as a tool to support self-recovery in an effective way and enable a lasting understanding of hazard-resistant construction principles.
4. To get an insight on the priorities and prior knowledge of local households is based on other research methods on how to support self-recovery in an effective way and enable a lasting understanding of hazard-resistant construction principles.

1.3 Research questions

The main research question of the overall research is:
What are the measurable fail and success factors and actors of influence on the adoption of hazard-resistant construction principles by construction professionals and end-users to enable more hazard-resistant housing and how can knowledge exchange interventions enlarge the adoption?

There are multiple sub-questions to gain some information which will help answering the main question. The main- and sub-questions which are answered in this graduation thesis are the following questions:

Main research question: *What characteristics are recommended for a knowledge exchange support tool that is effective in the support of self-recovery and enables a lasting understanding of hazard-resistant construction principle for the reconstruction process in Nepal?*

Sub Questions:

1. *Which tools are effective in the support of self-recovery and enable a lasting understanding of hazard-resistant construction principles based on theory?*
2. *Which tools are effective in the support of self-recovery and enable a lasting understanding of hazard-resistant construction principles based on experts?*
3. *What existing knowledge exchange support tools are effective in the support of self-recovery and enable a lasting understanding of hazard-resistant construction principles?*
4. *What are the priorities and prior knowledge based on the surveys, focus groups and structural assessments?*

1.4 Hypothesis

The following hypothesis is set:

- The knowledge which is shared by humanitarian organisations is not adapted to local communication ways.
- The knowledge which is shared by humanitarian organisations is not adapted to the local knowledge level.
- Message to build back safer is constantly changing and changing from expert to expert. It is unclear what information can be trusted.
- Lack of effective knowledge exchange.
- The knowledge chain is in the following order: shelter clusters - ngo/ engineers - carpenters - householders.
- All actors in the knowledge network have influence on the adoption.
- Knowledge chain is not effective in communication.
- Engineers who share knowledge with carpenters keep the knowledge often for themselves, because of status.
- Trained masons are not working in their own community, but in a foreign country or another. rich area to earn more money)
- NGOs do not communicate in an effective way with communities.

2.0 Research Methodology

This methodology chapter is written by Eefje Hendriks and Ranon Caris:

This chapter explains the overall research methodology of this thesis. This research is part of a bigger study. This larger research project is divided in different research tools. Each graduation student is responsible for one part of the results. Ranon Caris is responsible for, an extensive literature study around knowledge exchange methods, the execution and analysis of expert interviews around knowledge exchange and the analysis of one case study in the field. This thesis will describe these results.

Through triangulation of different research methods the adoption of hazard-resistant construction principles is mapped in retrospect The researches is divided in multiple research methods; (1) literature review, (2) expert interviews, (3) case study, (4) field study.

2.1 Literature review

There is a wealth of literature on the subject of knowledge intervention both from academic and agency sources. In this chapter a couple of literature sources and models are gathered and which will be analysed and discussed. The literature is chosen based on experts Verine Vissers, Tonnie van der Zouwen and Eefje Hendriks. This literature will give insight in how humanitarian organisations should share knowledge with communities so households will adopt new knowledge. From these sources, a selection has been made on the basis of the appropriateness to the context, and are discussed in this sub-question.

2.2 Expert interviews

Next to the literature insight is asked from humanitarian experts on the effective use of knowledge interventions. Very little field specific literature has been written on this topic. The vision of experts on the effective knowledge exchange in the context of post-disaster reconstruction is important to consider. Experts provide field based insights which are difficult to obtain from literature.

Experts have been selected through snowballing. By asking each expert after the interview if they know another expert which might be interesting to talk to.

Criteria on which the experts are selected are:

- Expert on self-recovery
- Familiar with the situation in Nepal
- Familiar with giving interventions
- Familiar with observing and measuring research
- Expert on designing an intervention

The experts are selected by the criteria above. The experts will be interviewed and asked for feedback on the protocol. The data that is gathered by interviewing these experts will lead to an opinion about a design for the intervention. In this way we can compare the opinion with the literature on how an intervention needs to be provided. The following experts are selected to provide information on these subjects.

2.3 Case study

This case study is based on 6 interviews with key-stakeholders involved in the reconstruction program of Lumanti in Nepal. This article will compare the inputs in how to support in knowledge exchange for the adoption of technical guidelines in Nepals post-earthquake reconstruction processes based on the interviews, the earlier documentation of their organization and the literature. In the interview special attention is paid to their experiences in sharing their knowledge. Next to that, 3 field visits have increased the understanding of the context. Additional information is found in earlier documentation made by Lumanti and in suggested communication strategies from literature.

2.4 Field study

The adoption of hazard-resistant construction principles can be explained by comparing the adoption in two earthquake affected districts in Nepal. This comparison measures the effectivity of given knowledge interventions in one district and compares it with a district with little interventions. The research aims to find what makes people adopt technical knowledge. This field study is based the household surveys, the focus group discussions and the structural assessment which are executed in the areas Gorkha and Okhaldhunga in Nepal. This article will give insight in the outcomes of this collected data.

This article increases the understanding about what enables people to build back safer, and what prevents others from doing so. This has been done by comparing the reconstruction in two earthquake affected districts in Nepal. After the earthquake in 2015, Gorkha district has received extensive and various technical knowledge interventions, whereas Okhaldhunga district has received little to no technical assistance in the reconstruction process.

To increase the understanding of the adoption process in practice, different theories are used as a basis for the assessment. The study analyses the 3 determinants of the MAO-model; Motivation, Ability and Opportunity. The MAO-model allows the categorization of participants in groups based on high or low scores for these determinants, and supports designing suitable strategies to promote wider adoption. Next to that, 'trust' is analysed as literature has shown that it is also of significant influence on the adoption process in the communication.

The study used different methodologies, both qualitative and quantitative to triangulate findings; (1) Focus Groups, (2) Key-stakeholder interviews, (3) Household questionnaires, (4) Structural assessments, (5) General ward data, (6) Participation in construction work. A total of 1457 questionnaires, 26 focus groups, 1457 structural assessments and 70 key-stakeholder interviews were conducted in 26 wards in 8 VDC's in Gorkha and 14 VDC's in Okhaldhunga.

The used methodologies, household surveys, focus group discussion and structural assessment are explained in the following alinea's. Other students of the research team gathered data with other research methods contributing to the same research goals. Gijs van Duren was responsible for the household surveys, Jim de Kort for the structural assessment, Sandra van Ekeren for the focus groups and Benjamin Schep for the key-stakeholder interviews As part of this research team, Ranon Caris contributed to the full collection of data for all the other students next to his own data collection and received limited assistance in his own data collection. The research methods, the hypothesis and the research locations will later on be described in this report.

Household surveys
A 'Household Survey' is the process of collecting and analyzing data that helps to understand the general situation and specific characteristics of individual household or all households in the population. During a household survey, field researchers investigate and record facts, observations and experiences from the sample households which are representative of all households in the study area. (*Understanding Household Surveys*)

Focus group discussion
A focus group is a gathering of people who participate in a planned discussion that is intended to start a discussion about a particular topic or area of interest in an environment that is non-threatening and receptive. The focus group is a collective on purpose. Unlike an interview, which usually occurs with an individual, the focus group method allows members of the group to interact and influence each other during the discussion and consideration of ideas and perspectives. (*Focus Group Discussion*)

Structural assessment
A structural assessment is a procedure utilized to check the adequacy, structural integrity and soundness of structures and their components. An assessment is made to evaluate a structures current and future use and conformance to current building codes and guidelines. (*Structural Engineering*)

The first research location will be in Gorkha. Gorkha is a district where a lot of training has been given. Different strategies of dissemination have been tried out. In the beginning knowledge was not

adopted to a large extend, but apparently something turned it around and messages did get applied. CRS and other NGOs assumed that the door to door method has made a difference in the adoption process. Our goal in Gorkha is to measure the barriers and failure mechanism of influence on knowledge adoption related to the interventions that have taken place.

The second research location will be in Okhaldhunga. Okhaldhunga is a district where only 4 NGOs have been involved but there has been a higher compliance. It is expected by the research team that there are probably vulnerable groups and issues with land rights, gender, people tend to be more illiterate than in Gorkha, women have little voice in the communities and there is difficult access to construction markets. Communities are selected which have to a limited extend received technical assistance from NGOs in their reconstruction to be able to learn from their recovery process without influences from NGOs. The goal in Okhaldhunga is to measure barriers and failure mechanisms of knowledge adoption experienced by different vulnerable groups that self-recover in comparing with Gorkha where this is not.

'Figure 1, Location of the earthquake that hit Nepal on April 2015'

3.0 Literature review

Which tools are effective in the support of self-recovery and enable a lasting understanding of hazard-resistant construction principles based on theory?

Contributors

This sub-question is developed by Eefje Hendriks and Laura Howlett in collaboration with the students Ranon Caris, Jason Raoul Ramos Silva, Dennis van Nijnatten.

3.1 Introduction

Development and Humanitarian agencies have been using knowledge interventions for decades with the intention of influencing an improved practice of development processes. Knowledge interventions have seen some huge successes, but also has suffered from significant failures and unintended outcomes. There is a wealth of literature on knowledge interventions from both academic sources and humanitarian agencies.(Hendriks, E., 2017, Dec)

Literature around the effectivity of knowledge interventions is will inform the design of potentially more effective knowledge interventions. The sources for this literature review are chosen based on experts Verine Vissers, Tonnie van der Zouwen and Eefje Hendriks. This literature review is based on literature about Action research (Zouwen, 2018), the MAO model for Motivation, Ability and Opportunity (Stokmans, 2005), Bloom's Taxonomy Revised (Krathwohl D.R., 2002), Designing Effective Instruction (Morrison, Garyr. & Ross, Steven, M., dec 2012).

To get a clear view on the current situation on the adoption of knowledge the following literature is used: Knowledge exchange and adoption to enable safer post-disaster-self-recovery (Hendriks, E., 2017, Dec).

3.2 Literature Models

3.2.1 Action Research

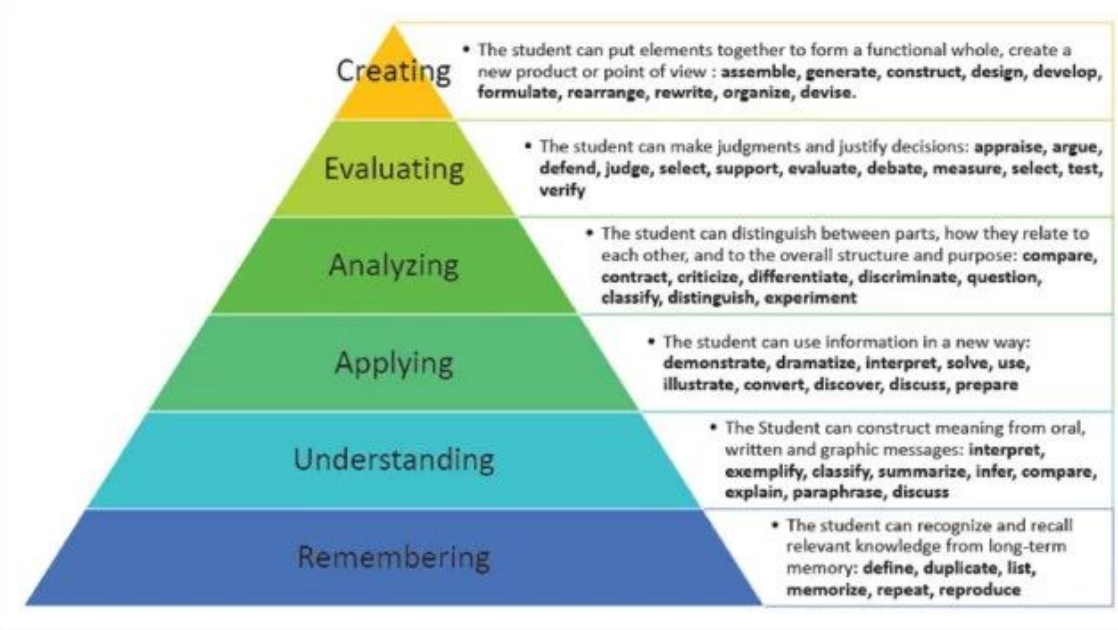
The theory of action research (Zouwen, 2018) argues that it is important to get consensus through discussing with the participants. In action research it is important that the organizer of the interaction does not provide the group with information but lets the group come to a consensus on what step to take next. In the case of enabling people to reconstruct a safer house the group is in need for new information. The action research method however is useful because of the active involvement of the participants. While discussing about the subjects and problems it is important to listen to their solution or idea. By talking about these solutions and ideas it is possible to discuss this and tell them your own idea about this. Discuss this and achieve together one solid solution for the subject or problem. The action research method could enable the group to find a construction method that is useful within the limitations they find themselves in. With action research it is also possible to gather data of the participants. Motivation and ability will be tested by observation and will be compared after each intervention.

3.2.2 MAO Model

The theory of MAO (Stokmans, 2005) says that the probability that people would adopt new knowledge will increase when motivation, ability and opportunity are high. The theory is useful to make groups based on their potential to adopt new knowledge. Different strategies can be defined for the different groups. Based on this theory a figure is added that illustrates the target group for the knowledge intervention. The strategy is based on location and the type of participants.

3.2.3 Bloom's Revised Taxonomy Model

The theory of Bloom's Taxonomy Revised (Krathwohl D.R., 2002) is a model that represents levels of thinking skills, categorised from low order to high, as follows;. 'remember, understand, apply, analyze, evaluate and create'.

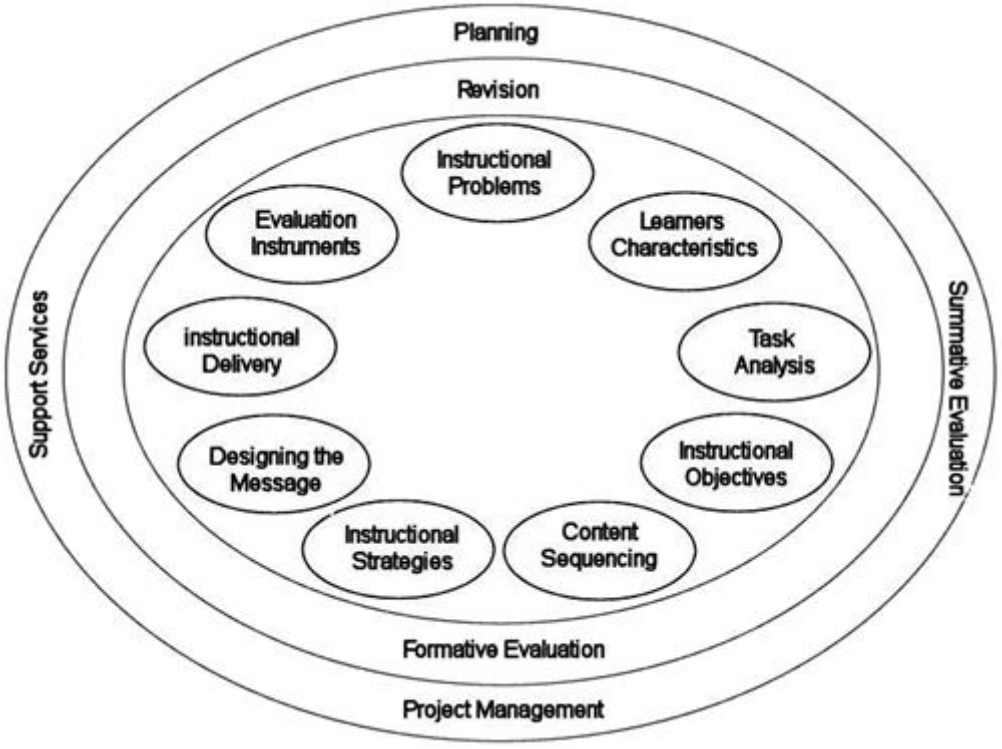


'Figure 2, Pyramid of the levels of cognitive processes'

It describes the characteristics of the learning stage reached, and gives an indication of what the student needs to be able to do with new knowledge to reach the next stage. This allows researchers to establish the start point or baseline for the learning experience. In this study, this translates as providing a way of categorising communities or individual households prior to intervention.

3.2.4 Designing Effective Instruction

According to Designing Effective Instruction displayed in figure 1 (Morrison, Garyr & Ross, Steven, M., dec 2012) knowledge interventions can be designed.The summary of this model is included in appendix 12. This model 'Designing Effective Instruction' is used according to the interview with expert Verine Vissers which is included in Appendix 13. With this model it is able to give recommendations on how to instruct participants with new knowledge. Figure 3 shows all the components of the instructional design plan.



'Figure 3, Components of the instructional design plan'

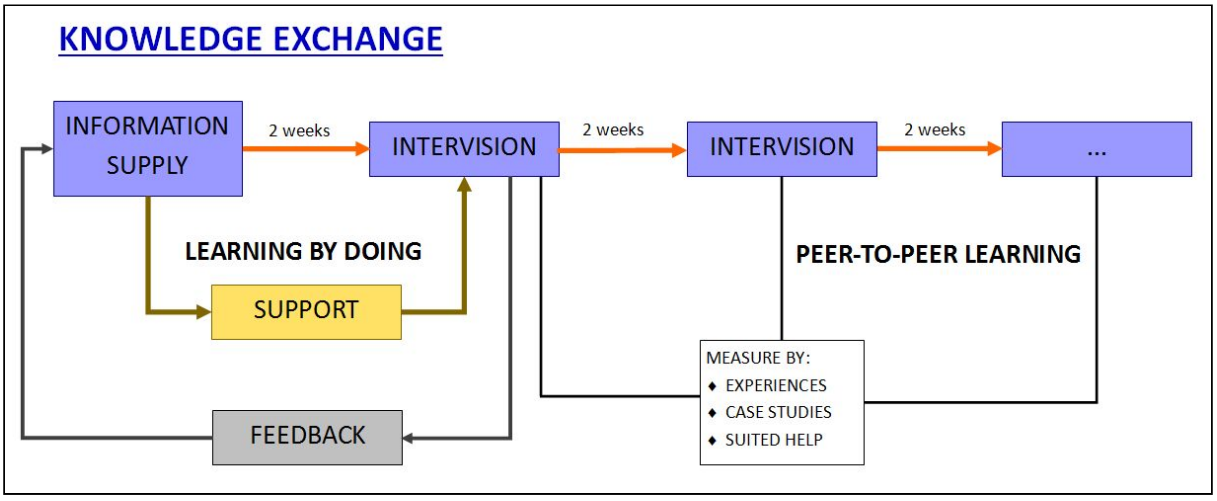
According to this model we can conclude that it is important to overthink the instruction sequence in interventions. The eventual choice is to integrate the information for the learners. By using the ERGUL principle students need to form rules and principles for hazard-resistant construction on their own. This will prompt the students to review their own situation and take the effort to make the information understandable for themselves. The use of images and examples could be a major element in the knowledge interventions. The most images could have the function of transformation, which helps the learners to make the info clear and use it in practice.

3.3 Conclusion 'Theoretical design of intervention'

Design principles of the knowledge intervention to increase ability to apply hazard-resistant construction principles

Sequence of knowledge interventions

As shown in the figure below, a sequence of actions is proposed to have an effective knowledge intervention. This figure is based on the recommendations of the literature and the experts.



'Figure 4, Sequence of actions for an effective knowledge intervention'

3.3.1 Information Supply

The first step is the information supply which is based on the principles of knowledge exchange as explained in the literature study (Kaklauskas, Amaratunga, Haigh, 2009). This step is meant to increase the ability of the participants. The information supply will find way in the form of interventions to stimulate knowledge exchange. To make sure that the information is provided as in an exchange session, there are some aspects to take account:

- An appropriate room
- Suitable information
- Possibility for the use of tools

The intervention is based on the principles of knowledge exchange/ action research / companion modeling (Kaklauskas, Amaratunga, Haigh, 2009; Zouwen, 2018) because earlier research has shown that only transfer is little effective. During the intervention a few aspects are monitored:

- Does knowledge exchange take place?
- So does the intervention leader also learn?
- Is there knowledge development?
- Does the intervention leader change the session based on the knowledge in the group?
- Why is the knowledge adopted or not?

By supporting the participants after the interventions the participants will be able to apply the knowledge into practice. If the support is accepted and understood, it will result in better outcomes of the intervision.

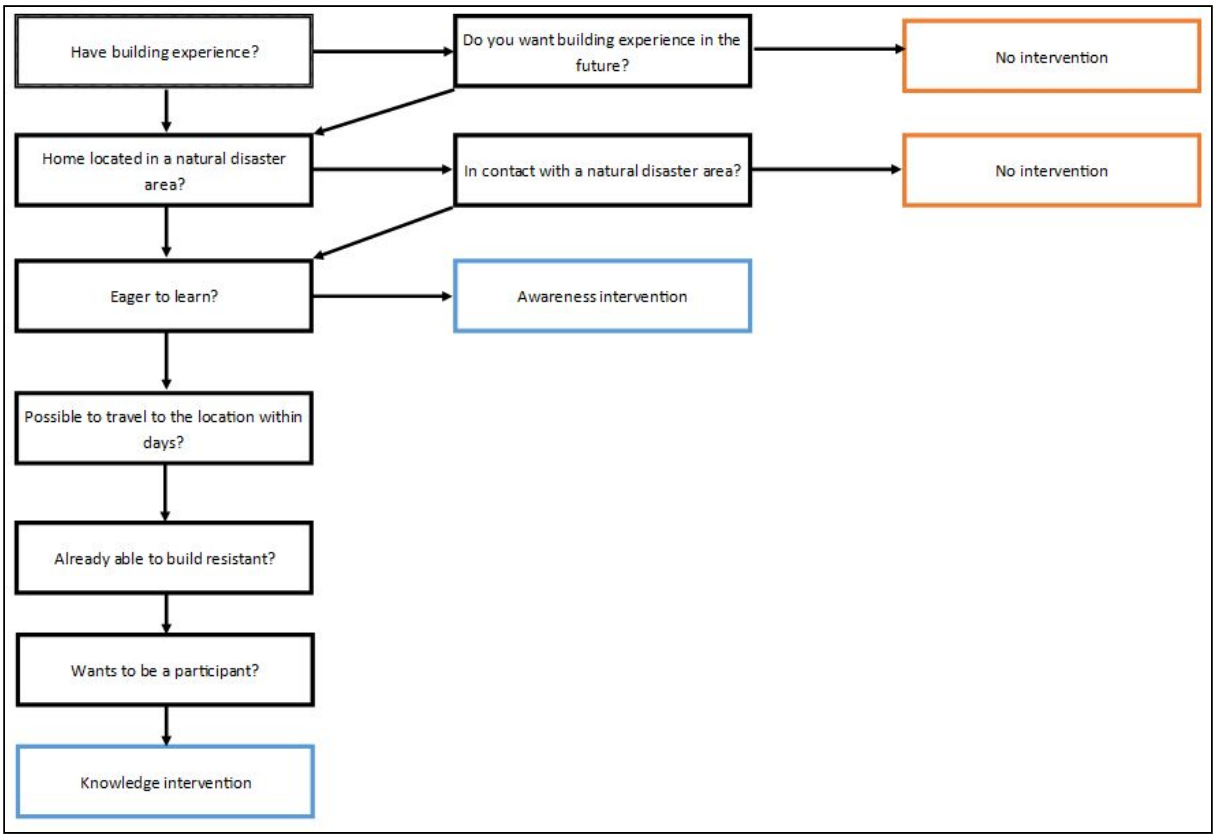
3.3.2 Intervisions

The next step is to support some of the participants in the application of the given knowledge in practice. This enables some of the participants to share their experience with the other participants. By sharing the problems and solutions they find while constructing, they will be able the remain a high motivation. Meetings like this can also be a method to keep the participants motivated as they talk about their experiences (Wiggens, 2004). This is called an intervision group. The intervisions are based on peer-to-peer learning. The intervision meetings give a clear image about the adoption of the knowledge. Outcomes of the intervision meetings can be used to refine the intervention. Therefore it is very important that the results of the intervisions can be measured. This is also mentioned in the flow diagram. The intervision meetings could be organised once per two weeks. If possible, the meeting will be held partially next to a house in construction of one of the participants. During the intervisions a few aspects are monitored based on action research (Zouwen, vd. T, 2018).:

- What experience does the group now have?
- Do they need extra information?
- Is the knowledge applicable?
- Is the experience positive or negative?
- What degree of guidance do they need?
- Do they trust the quality of the information given?
- Do they need personal guidance?

3.3.3 Participant sampling

The selection of participants is based on differentiation according to the MAO model. To select only relevant people out of the communities we developed a flow-chart to filter those who could participate to the interventions. The flow-chart which is based on previous research of Eefje Hendriks is placed below.



'Figure 5, Flow-chart participant sampling for intervention'

After the selection of the participants follows the differentiation via the MAO model. The focus lays on the motivation and ability for the reason that the influence from the researchers on opportunity is limited. The characteristics of the participants could be measured by a baseline assessment. The interpretation of the differentiation is found below.

Table 1:
The Eight Segments of the MAO-Model of Audience Development

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

'Table 1, The eight segments of the MAO-model of audience development, (Stokmans, 2005)'

The outcome of the differentiation is subdivided in four scenarios:

- Motivation high + Ability high
- Motivation high + Ability low
- Motivation low + Ability high
- Motivation low + Ability low

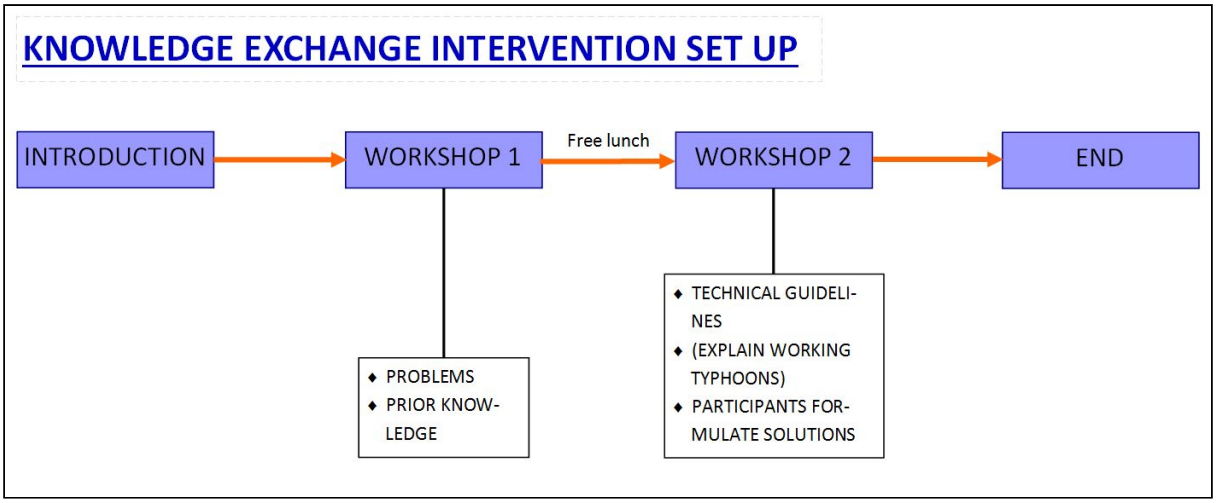
This results in two types of training. The first training is meant for those who have a high motivation to build hazard-resistant constructions. The participants with a high motivation do not need to be made more aware of the need to build hazard-resistant. In this type of intervention the attention can be focussed on the knowledge exchange itself.
In the case of a low motivation, there must be payed attention to the need of hazard-resistant housing. When the participants are aware of the need to build hazard-resistant constructions, there can be continued with the exchange of knowledge about hazard-resistant building.

3.3.4 Technical guidance

The group is asked who is planning to apply the new knowledge in their daily practice. These participants are guided by the researchers or by the involved local stakeholders to apply this knowledge and help them overcome problems they encounter. This guidance is based on the principles of "learning by doing" (4.2 Conclusion).

3.3.5 Structure of knowledge intervention

Operational knowledge is best shared in an anecdotal form (Hendriks, E., 2017 Dec.). Therefore, the intervention is a cycle of anecdotal steps. The main content of the intervention will contain two workshops. The first workshop will be about the problems carpenters face during housing. By talking about their problems the researchers will be able to get a better understanding about the issues the carpenters have. Within this first part of the intervention the participants will also be asked why they think they have the mentioned problems and what they think what will solve their problems. By letting the participants draw the solutions the research-team will also get to know the knowledge level of the participants.
The second workshop will be used to provide the technical guidelines. If needed, this part of the intervention can be used to explain the effects of earthquakes on houses. In the last part of the second workshop the participants have the opportunity to transfer the principles in an understandable way for themselve via notes or drawings.



'Figure 6, Knowledge exchange intervention setup'

4.0 Expert interviews

Which tools are effective in the support of self-recovery and enable a lasting understanding of hazard-resistant construction principles based on experts?

Contributors

This sub-question is developed by Ranon Caris.

Reviewers:

- Eefje Hendriks (TU Eindhoven)

The selected experts are:

List of international humanitarian stakeholders:

- Milan (CRS)

List of local humanitarian stakeholders:

- Lumanti Joshi (Lumanti)
- Khitiz Pokhrel (BuildChange/government engineer)
- Hari Devkota
- Bhijesh (Cordaid trainer/engineer)
- Pravesh Khanal (Lumanti coordinator)

In total a number of 6 experts have been interviewed via a semi-structured interview. In the interview success and fail factors of knowledge adoption via a knowledge intervention have been identified. There will also be a clear view on the current interventions. With this clear view the interventions will be compared on opinion from the experts. There will be a total opinion on how to provide an intervention according to experts. The voice recordings of the interviews are included in Appendix 2-7.

4.1 Experts Input

This chapter is based on the information which is gathered during the interviews with 6 experts. The semi-structured interviews followed the interview protocol (Appendix 1).

The interviews are included in the following appendixes:

- Appendix 2 - (Milan Mukhia)
- Appendix 3 - (Bhijesh)
- Appendix 4 - (Khitiz Pokhrel)
- Appendix 5 - (Hari Devkota)
- Appendix 6 - (Lumanti Joshi)
- Appendix 7 - (Pravesh Khanal)

- ***Why did you choose for this method to share your technical knowledge?***
    - *The method was provided by the government (Milan)*
    - *Because explaining and convincing people in a practical way is a lot clearer and people will understand more easily. (Bhijesh)*
    - *The use of paper and sketches is effective, because the old households could not read and write in most cases. (Khitiz)*
    - *Discussion is effective, because people can exchange their thoughts and discuss about it. (Khitiz)*
    - *Being on a local level created a comfortable feeling between the households and me. (Khitiz)*
    - *Show pictures while telling the masons and households how to build, because people can really see an example of a safe house. With examples households and masons are more easily convinced. (Hari & Pravesh)*

- *Constantly changing the method according to the current situation on the local level. (Lumanti)*

- ***What problems did you face in the way you share your knowledge?***
  - *Language problems, because in the rural areas there were local languages. (Milan)*
  - *It is challenging to convince people to invest more money in their house. For engineers this costs a lot of work and time to convince them. (Bhijesh & Khitiz)*
  - *Get masons in training who would also be a mason in the future. (Khitiz)*
  - *The homeowners often copy the wrong house. They don't follow the reference the engineer gives, but they follow their neighbor or family. (Khitiz)*
  - *A 7-day training to masons is too long. Because masons could earn money in these 7-days they would not come to the training. A 1-day training with practical support on the construction site worked better. This because a 7-day training was too much of information without practical examples. (Pravesh)*
  - *Some of the households and masons were illiterate, so they made mistakes in their reconstruction after we provided them with training and written text on how to build. It is hard to learn them building techniques that they never used before. (Pravesh)*

- ***What aspects make your approach enlarge the application of technical guidelines by households?***
  - *Door to door visits by social mobilizers. (Milan)*
  - *Use of feedback boxes were people can drop and share their opinions and feedback so we can improve our process. (Milan)*
  - *Provide simple handouts to masons with easy to understand information. (Milan)*
  - *Giving the technical inputs on the construction site with practical examples. Let mason learn by doing, because they are analphabetic. They didn't study before this training, so it is really difficult to let them study now. (Bhijesh)*
  - *Keep it simple, explain the information in a simple way so low educated people could understand the information. (Khitiz)*
  - *Good relation with local leaders and influencers, so other people would trust me. (Khitiz)*
  - *It is effective to convince a difficult homeowner with individual meetings, because they can be personally motivated. (Khitiz)*
  - *Work on a local level with the households. The community gets trust and because of this they accept and get convinced. (Lumanti)*
  - *A day to day visit is essential for the households. The engineers visit each house every day so when they made a mistake they will know it the same day. (Pravesh)*

- ***What aspects of your approach limit the application of technical guidelines by households?***
  - *They can not read and write, so the mason training with a presentation was difficult to understand for masons. (Bhijesh)*
  - *Engineers could often only support 4 communities each month, so they were not able to share knowledge with a lot of people. (Khitiz)*
  - *Households only understand the basics of the information, because it is shared in a simple way. (Khitiz)*
  - *Most people can not remember everything which was taught them. (Khitiz)*
  - *Households and masons could not have technical assistance at time. (Khitiz)*

- *Most of the households hire a mason or contractor to build their newhouse. These households depend on how the mason will build their house. Because of this households can not decide themselves how their house should be build. (Hari)*

- ***What aspects could be improved in your approach to enlarge the application of technical guidelines by households?***
  - *More focus on retrofitting, because this saves a lot of money and is sustainable. (Milan)*
  - *Tranches are a too small amount of money. (Milan)*
  - *Learn masons the earthquake resistant construction principles by supporting them on the construction site. (Milan)*
  - *Show more examples in the practical way. Compare safe and unsafe houses in the field. And tell people why the safe one is safe, and why the unsafe one is unsafe. (Bhijesh)*
  - *Setup a governmental call center which is 24/7 available. (Khitiz & Hari)*
  - *Let the masons share their knowledge and questions online with each other. (Hari)*
  - *The government needs to improve their guidelines so that it becomes easier for the households to apply them and to understand them. But they also need to make it less expensive. They also need to speed up the process of making the guidelines so that they are early available when people start their reconstruction. (Pravesh*
  - *Giving the masons training a little bit earlier and longer. So that the masons are well trained when they start reconstructing in the field. (Pravesh)*

- ***Do you think masons and households consider the person who exchanges knowledge as 'experienced' on the topics they are advising on? And why?***
  - *Yes, because of my experiences. (Milan, Bhijesh & Hari)*
  - *Eventually the masons would be convinced, because masons were a little bit difficult to convince. This because the masons would not listen to a young student with a lack of experiences on the construction site. After explaining with local practical examples they would be convinced. (Khitiz)*
  - *The house owner would accept and trust us. And we got their trust with regular interaction. Whenever the households see the techniques been implemented in the community they start to see you as an expert. The people just see and believe. With continuous contact we create a band with the people so they are going to trust me. (Khitiz)*
  - *Yes, because the households and masons know that the organisation works in the shelter program for a long time now and that we have the expertise on reconstructing. (Lumanti)*
  - *Yes, because the person gains their trust by providing the households and masons the government guidelines and in the field a government engineer came and explain them the same information as they received so that is what gave the households and masons trust. (Pravesh)*

- ***What aspects do you think that limit the application by the masons?***
    - *A lot of masons moved to another country, because they could earn more money. (Milan)*
    - *Households can not pay the masons after the first tranche, because they need to wait 3 months for the next tranche. Because of this masons need to wait for 3 months, so they move on to another construction site. This delays the construction time. (Milan)*
    - *Households which were not aware could not be convinced by masons to build in the safe way because it is too expensive for the households. (Bhijesh)*
    - *Some provided trainings are too difficult to understand for the masons. The way of building is too different from what the masons are used to. It is better to improve the current way of building instead of providing a complete new way. (Hari)*

- ***To what extent do you think masons are aware of earthquake resistant construction principles?***
    - *The masons are aware. (Milan & Hari)*
    - *The masons are aware, but in a few cases after the organization stopped supervising the masons were making the bands a little bit thinner so the house would be less expensive for the household. (Bhijesh)*
    - *Before the earthquake they were not so much aware of the principles, but after the earthquake they became aware of the principles. (Pravesh)*

- ***What problems do masons face when they need to apply the earthquake resistant construction principles?***
    - *There is a lack of technical people with knowledge to build back safer in not supported areas. (Milan)*
    - *After masons got the training, they would still need support from engineers in the first houses they construct. Engineers need to supervise very strictly if masons are doing their job in a correct way. After constructing the second/third house masons would really understand what and why they should build it in this way. (Bhijesh)*
    - *Wood is expensive. (Hari)*
    - *Lack of labours. (Hari)*
    - *Household does not have enough money to invest. (Pravesh)*

- ***What did you do to help them to solve those problems?***
    - *Supporting the masons on the construction site by telling them what to do and explaining why. (Milan)*
    - *Supervising the masons on the construction site at the first two/three constructions. And explain all the principles with a practical examples. (Bhijesh)*
    - *Engineers should go to the construction site with 10 to 15 questions and ask the questions to the trained/not trained masons at the building site. If that mason is able to answer 5 to 10 questions correct, he is able to build a little bit earthquake resistant. If the mason can not answer the questions correct, train him in the aspects he does not know and ask him the questions again a couple of weeks later. (Hari)*

- *At the critical parts like the bands is our team monitoring at the construction site. So when they do not do it right the masons will get help and will be taught how to do it. (Pravesh)*

- ***To what extent do you think that masons are willing to apply the earthquake resistant construction principles?***
  - *Most of the masons can apply these techniques, but not all the masons are qualified to build back safer. Because the 7-day training is too short to learn all these techniques. (Milan)*
  - *Masons are willing to apply these techniques, but a lot of house owners are forcing the masons to build less expensive and decrease the safety of the construction. (Bhijesh & Hari)*
  - *The masons are willing to apply in the future. (Lumanti)*
  - *They are willing to apply it, because the masons have to follow the guidelines, so they have to. But if the government would be out of the picture then the masons want to build how they used to. (Pravesh)*

- ***To what extent do you think masons are able to understand the earthquake resistant construction principles?***
  - *The 7 day training is not enough to convince and explain the masons all the information about building back safer. But we can't really explain them in detail, why they should do this. Those technical aspects are missing in the 7-day training, and because of that 50-day training should be provided to the masons. They will understand the information with practical examples. (Milan, Bhijesh, Lumanti & Pravesh)*

- ***To what extent do you think masons are able to built a design different from the government design with those technical guidelines?***
  - *Masons know they need to build a safe house, but they do not really know how to specifically build a safe house. (Milan)*
  - *The masons will also apply the techniques in another design, because they know why these techniques are important and how these techniques help to have an earthquake resistant house. (Bhijesh & Lumanti)*
  - *The masons are able to built a design different from the government design if they keep updating their skills, they are aware what is safe and what is not. (Hari)*

- ***If they don't understand the information, what do you think is the reason?***
  - *During the training all the masons are saying they were understanding the information. But if we looked on the construction site they were not applying these techniques. Because they don't really understand the information which was provided by a presentation. That's why we also supported the masons on the construction site with practical examples. It's important is to really explain why they should build it in this way. (Bhijesh)*
  - *Because of the masons do not understand the language. (Lumanti)*

- ***What actions did you take to increase their understanding?***
    - *Technical colleges for all the students. (Milan)*
    - *Share knowledge on a local community level. (Milan)*
    - *Invite community stakeholders to show them the how the model houses are constructed. (good relation with local stakeholders) (Milan)*
    - *Use demo houses (Milan)*
    - *Use of Radio for sharing knowledge (Milan*
    - *Exhibition in community level about how to build back safer (like a community meeting) (Milan)*
    - *Provide a 7-Day training with guidance on the construction site. This way is less time consuming and less expensive for organizations. (Bhijesh)*
    - *Share information in local language, because in this way people will understand the information. (Hari)*
    - *If the masons are not reconstructing properly, they would be taken to another construction site where masons are reconstructing properly. In this way they can learn from each other. (Lumanti)*

- ***What aspects do you think that limit the application by the household?***
    - *The homeowner can not read and write. The drawing that is provided by the Nepal government can not be read or understand by the households. So it is really difficult for the households to see and check what the masons are building. And also the technical person can not reach in time, because they are limited in numbers. (Khitiz)*
    - *The households can not find trained masons, because there is a lack of masons. (Khitiz)*
    - *The homeowner is not motivated by themselves to invest in an earthquake resistant construction. Because they want to build within the amount of tranches. (Khitiz)*
    - *The house owner is misinterpreting the information or just not convinced why to build safe. (Khitiz)*
    - *The inner will to build earthquake resistant is missing. (Khitiz)*
    - *The lack of money. A lot of households can not apply the techniques because they do not have enough money for it. (Hari)*

- ***To what extent do you think households are aware of earthquake resistant construction principles?***
    - *They are aware of the safety of their house, but because of the costs they are not really willing to apply it. (Bhijesh)*
    - *They are and they are not, because people who can read and write have developed some awareness. They have some access to the resources which the government provided. The local people who can not read and write could only get the information during a community meeting or support by an engineer. (Khitiz)*
    - *The households are willing to apply the principles, because in 1990 there has been an earthquake and those households did not apply techniques after the earthquake and now those houses collapsed because of this earthquake. So people are very aware of the consequences when they do not apply the techniques. (Pravesh)*

- ***What problems do households face when they need to check the earthquake resistant construction principles?***
    - *House owners can not document their own house. And could not check the process of their house. This because they can not read and write. If the masons would make a mistake, the house owner need to pay for it. (Khitiz & Hari)*
    - *The government does not have a checklist for the households to monitor their own construction. (Khitiz)*

- ***What did you do to help them to solve those problems?***
    - *In the future some sort of simple checklist for homeowners should be made so households can check their own house during the reconstruction. (Khitiz)*

- ***To what extent do you think that households are willing to apply the earthquake resistant construction principles?***
    - *No, the households are not willing to apply this, because it is more expensive. (Bhijesh)*
    - *People who can read and write are convinced by us, but people who can not read and write could easily be influenced by others. People who can read and write can match the information themselves with other references. (Khitiz)*
    - *The households are willing to apply the earthquake resistant construction principles, but they do not have the resources for it. (Pravesh)*
    - *A lot of households still want to live in their old house. That is why they are not willing to apply these techniques. Introducing retrofitting could solve this problem. (Pravesh)*

- ***If not, what did you do to increase the willingness of households?***
    - *Convince the households with references and get their trust and explain how important these techniques are with examples. (Khitiz)*

- ***To what extent do you think households are able to understand the earthquake resistant construction principles?***
    - *Households can understand the basic things, but they can not understand how the box principle works. The households know what to do, but not why. (Khitiz)*

- ***To what extent do you think households are able to built a design different from the government design with those technical guidelines?***
    - *People are currently building the government designs, because they are forced. In the rural area it is very difficult to still build the earthquake resistant design, because of a lack of materials. (Khitiz)*
    - *50% Of the households are currently not building a new safe house and those who have built a new house are mostly the households with a collapsed house or the households who want to receive the tranches. 10 to 20% of The households built their house in a safe way, because they understand why. (Khitiz)*

- ***If they don't understand the information, what do you think is the reason?***
    - *They would be able to if they knew they had the money to use the techniques. (Hari)*

- ***What actions did you take to increase their understanding?***
    - *Give them awareness by telling the households that they are not living in a safe house. Give people knowledge about the differences in costs between a safe building and an unsafe building, because a safe building increases the costs only with 5%. (Khitiz)*
    - *Support households by sharing information by radio. (Khitiz)*

4.2 Conclusion

To answer sub-question 2 according to chapter 1.3: '*Which tools are effective in the support of self-recovery and enable a lasting understanding of hazard-resistant construction principles based on experts?*' it is possible to say that there are different approaches to support self-recovery in an effective way and enable a lasting understanding of hazard-resistant construction principles.

According to the experts it is able to conclude the following recommendations to have an effective support of self-recovery and enable a lasting understanding of hazard-resistant construction principles based on experts:

Recommendation according to the experts:

- *Door to door visits by social mobilizers. (Milan)*
- *Use of feedback boxes were people can drop and share their opinions and feedback so we can improve our process. (Milan)*
- *Provide simple handouts to masons with easy to understand information. (Milan)*
- *Giving the technical inputs on the construction site with practical examples. Let mason learn by doing, because they are analphabetic. They didn't study before this training, so it is really difficult to let them study now. (Bhijesh)*
- *Keep it simple, explain the information in a simple way so low educated people could understand the information. (Khitiz)*
- *Good relation with local leaders and influencers, so other people would trust me. (Khitiz)*
- *It is effective to convince a difficult homeowner with individual meetings, because they can be personally motivated. (Khitiz)*
- *Work on a local level with the households. The community gets trust and because of this they accept and get convinced. (Lumanti)*
- *A day to day visit is essential for the households. The engineers visit each house every day so when they made a mistake they will know it the same day. (Pravesh)*
- *More focus on retrofitting, because this saves a lot of money and is sustainable. (Milan)*
- *Learn masons the earthquake resistant construction principles by supporting them on the construction site. (Milan)*
- *Show more examples in the practical way. Compare safe and unsafe houses in the field. And tell people why the safe one is safe, and why the unsafe one is unsafe. (Bhijesh)*
- *Setup a governmental call center which is 24/7 available. (Khitiz & Hari)*
- *Let the masons share their knowledge and questions online with each other. (Hari)*

- *The government needs to improve their guidelines so that it becomes easier for the households to apply them and to understand them. But they also need to make it less expensive. They also need to speed up the process of making the guidelines so that they are early available when people start their reconstruction. (Pravesh)*
- *Give the masons training a little bit earlier and longer. So that the masons are well trained when they start reconstructing in the field. (Pravesh)*
- *Technical colleges for all the students. (Milan)*
- *Share knowledge on a local community level. (Milan)*
- *Invite community stakeholders to show them the how the model houses are constructed. (good relation with local stakeholders) (Milan)*
- *Use of demo houses (Milan)*
- *Use of Radio for sharing knowledge (Milan)*
- *Exhibition in community level about how to build back safer (like a community meeting) (Milan)*
- *Provide a 7-Day training with guidance on the construction site. This way is less time consuming and less expensive for organizations. (Bhijesh)*
- *Share information in local language, because in this way people will understand the information. (Hari)*
- *If the masons are not reconstructing properly, they would be taken to another construction site where masons are reconstructing properly. In this way they can learn from each other. (Lumanti)*
- *Give the households awareness by telling them that they are not living in a safe house. Give people knowledge about the differences in costs between a safe building and an unsafe building, because a safe building increases the costs only with 5%. (Khitiz)*

5.0 Case study

What existing knowledge exchange support tools are effective in the support of self-recovery and enable a lasting understanding of hazard-resistant construction principles?

This chapter is written by Ranon Caris and reviewed by Eefje Hendriks.

5.1 Introduction

Knowledge adoption is often lacking leading to the reconstruction of unsafe housing after a natural disaster. Housing remains vulnerable to the hazard a country is facing. It is necessary to enlarge the adoption of hazard resistant construction principles by people that reconstruct houses after a natural disaster. One of the reasons why adoption is not taking place is because of the problem in the communication of hazard resistant construction principles. There is little documented about what are fail and success factors in the communication based on reflections from practitioners. In this article, the approach of the humanitarian organisation Lumanti in the reconstruction of Kathmandu Valley and Rasuwa is evaluated. Lumanti is open to share both their success, learning objectives and has a reflective attitude. The evaluation is based on Lumanti's employees own reflections, observations and comparing them with fail and success factors for effective communication found in literature. This evaluation is used to formulate fail and successfactors based on both field reflections and literature.

Hendriks, Luyten and Parrack(2018), have formulated recommendation for effective knowledge exchange for post-disaster reconstruction. The success factors are; (1) adapt knowledge to local need through exchange, (2) adapt knowledge to local skills and cognitive levels via contextualization, (3) adapt communication to local culture, (4) adapt knowledge to financial possibilities and priorities of low-income groups, (5) establish positively perceived consequences of knowledge adoption, (6) provide and enhance trust in the knowledge sender, (7) adapt knowledge to local building culture, (8) apply a community learning strategy.

The article by Hendriks, Luyten and Parrack does not explain how these recommendations should be applied in the field. In this article, the approach of Lumanti will be compared with the earlier indicated recommendations. This article will test the use of the recommendations in the context of Nepal and see if learnings can be found for the approach of Lumanti. The comparison will give insight into possible field application of those recommendations. This article will reflect on more programmatic application of the guidelines and possible fail and success factors in knowledge exchange for the adoption of technical guidelines in Nepals post-earthquake reconstruction processes . Next to that, improvements are formulated of the list of recommendations given by Hendriks, Luyten and Parrack for effective knowledge exchange.

5.2 Successfactors

According to the multiple internal interviews and to the visits to the head office in Kathmandu and the field office in Thecho the following successfactors are concluded. Lumanti's strategy and methods are included in appendix 9.

The use of constant adaptation of communication strategy supports the knowledge exchange for the adoption of technical guidelines in Nepals post-earthquake reconstruction processes. Because of the following methods Lumanti is able to have an up-to date program/strategy. They use all the possible knowledge and share this intern with all the employees and extern with other organizations. Every possible advantage is taken and used in the field. This is seen by:

- Flexibility in the program.
- Data is not recorded.
- Feedback meetings, each month the employees will share their experiences.
- Learning attitude in the organization.
- Engineers visit other field offices to learn from each other.
- Head office often visits and supports the field office.
- External experts are working for several Lumanti programs to support the employees with their knowledge and experiences.
- The previous training strategy of 7 days training is changed, because of the experiences in the field. Eventually this became a training orientation for masons where the masons were selected by households.

The use of informal and simple communication methods supports the knowledge exchange for the adoption of technical guidelines in Nepals post-earthquake reconstruction processes. This is seen by:

- Different approaches in the strategy
- Possibility to call with the employees
- Door to door support for the households.
- Face to face support for masons and households.
- Structure of the presentation for the mason orientation training is developed in collaboration with a technical school.
- Handbook which is easily understandable for people with a low knowledge level.
- The used language is easy to understand and doesn't use difficult terms.
- Community meetings are provided to the households to support their main questions and to clarify the way Lumanti is working in their community.
- Practical example is used during the mason orientation training.
- Maquettes and simple paper designs are used to share knowledge about the earthquake resistant construction principles.
- The mason orientation training is focussed on sharing the knowledge about the earthquake resistant construction principles and not the governmental design.

Because of this strategy the household gets trust in the organization. The information which is shared with the masons uses good examples and fits in the context. The knowledge which is shared is about the construction principles and about increasing the awareness of these principles causes high motivation of the masons.

Adaptation of design and construction process to local needs supports the knowledge exchange for the adoption of technical guidelines in Nepals post-earthquake reconstruction processes. This is seen by:

- Door to door needs assessments.
- Financial household analyses.
- Location of construction
- Future plans of the family
- Advice to retrofit or for reconstruction based on the current state of the house.

So personal advice can be given to households, because Lumanti analyzes the situation for each household. If households want to expand in the future Lumanti will take care of this in their way of supporting the household. This causes a better economic situation for the family, because they won't pay too much for the reconstruction or retrofitting of their damaged house. Also the reconstruction or retrofitting takes account for their current and future needs.

Gaining trust and insights through being long term field based supports the knowledge exchange for the adoption of technical guidelines in Nepals post-earthquake reconstruction processes. This is seen by:

- Engineers are during the whole program based in the community.
- A field office is placed in a central location in the community.
- Engineers are always available to receive calls and visit the construction sites.
- Households are able to visit the field office and ask their questions.
- The communication to the households is provided by social mobilizers which are living in the current community and hired for this job during the whole program.

So Lumanti gains trust from the households, because they know the social mobilizers. This is because they are often already trusted actors in the community. Also practical experiences during the support gains trust.

Strategic collaboration for community resilience supports the knowledge exchange for the adoption of technical guidelines in Nepals post-earthquake reconstruction processes. This is seen by:

- The local government is participating in the process.
- Each decision Lumanti makes is shared with the local government.
- Lumati is transparent in their work.
- Stimulate the ownership of the government.
- Making the government part of the most important decisions to have an effective use of the budget.
- Research the possibility of changing the legislation for the projects purpose.

So the government is able to support Lumanti in many ways, because Lumanti is working transparent with the government. Without the government's support it would be very difficult for Lumanti to do their work. This because Lumanti needs approvals from the government for the governmental tranches and approval to work in the community.

5.3 Conclusion

The following success factors contribute to support the knowledge exchange for the adoption of technical guidelines in Nepals post-earthquake reconstruction processes.

- The use of constant adaptation of communication strategy
- The use of informal and simple communication methods
- Adaptation of design and construction process to local needs
- Gaining trust and insights through being long term field based
- Strategic collaboration for community resilience

6.0 Field study

What are the priorities and prior knowledge based on the surveys, focus groups and structural assessments?

Contributors

This sub-question for the outcome of the research methods is developed by Ranon Caris in collaboration with the students Gijs van Duren, Jim de Kort and Sandra van Ekeren.

Reviewers:

- Eefje Hendriks (TU Eindhoven)

6.1 Introduction

The field research that has been carried out in Nepal increases our understanding about what enables people to build back safer, and what prevents others from doing so. This has been done by comparing the reconstruction in two earthquake affected districts in Nepal. After the earthquake in 2015, Gorkha district has received extensive and various technical knowledge interventions, whereas Okhaldhunga district has received little to no technical assistance in the reconstruction process.

To increase the understanding of the adoption process in practice, different theories are used as a basis for the assessment. The study analyses the 3 determinants of the MAO-model; Motivation, Ability and Opportunity. The MAO-model allows the categorization of participants in groups based on high or low scores for these determinants, and supports designing suitable strategies to promote wider adoption. Next to that, 'trust' is analysed as literature has shown that it is also of significant influence on the adoption process in the communication.

The study used different methodologies, both qualitative and quantitative to triangulate findings; (1) Focus Groups, (2) Key-stakeholder interviews, (3) Household questionnaires, (4) Structural assessments, (5) General ward data, (6) Participation in construction work. A total of 1457 questionnaires, 26 focus groups, 1457 structural assessments and 70 key-stakeholder interviews were conducted in 26 wards in 8 VDC's in Gorkha and 14 VDC's in Okhaldhunga.

The overall outcome of these different research methods can be found in this chapter. The total outcome of survey, focus group and structural assessment can be found in the appendix 10 and 11.

6.2 Outcome of the Surveys

This chapter describes all findings and conclusions from the household survey and is written by Gijs van Duren. This chapter is based on appendix 10. Each asked subject has its own findings and conclusions which will be described below.

6.2.1 Training

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. 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.

Provided information during training

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.

Not received training

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 actually 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.

Expert in building ‘earthquake resistant’

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%).

6.2.2 Knowledge needs

Design Plan

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 or 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%).

Information Questions by Households

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 61.6% of the participants said they want to know what materials are safe and Okhaldhunga 26.3%. what materials to use in general is answered by 64.8% while in Okhaldhunga only 28.3% 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 (34.2%), How to construct in general (25.6%), how to construct earthquake resistant (25.6) and what kind of foundation they should make (47.5%). In Okhaldhunga people often just want advice from an engineer (24.6%) they didn't have specific questions. With the gender perspective it is visible that more men (23.4%) than women (15.5%) want to know how they should construct earthquake resistant.

Information Actors

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 (48.9%) 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%). 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%).

No questions for information

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.

Information Sources

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.

6.2.3 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%).

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.

6.2.4 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.

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%).

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.

6.2.5 Awareness

It is important to see if people are aware of how they should build, what is safe and what is strong. The participants give as reason to know their house is strong, 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 (96.5%). 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.

The reason for people to think that their house is not safe in case of a big or small earthquake 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%).

6.2.6 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 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.

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.

6.2.7 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.

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.

6.2.8 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 probably is because a lot of people have only 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 were 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.[gvd1] 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 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%).

6.3 Outcome Focus Group Discussions

In this chapter the outcome can be found of the Focus Group discussions held in Gorkha and Okhaldhunga district and is written by Sandra van Ekeren. This chapter is based on appendix 11. In total 5 questions have been presented to separate groups of men and women. This chapter presents the statistical outcomes of these questions. In 2 communities the women didn't joined the focus group so there is no result of the women in those communities. That is why there are 26 communities with data of men and 24 communities with data of women.

6.3.1 Question 1

What limited you to build back an earthquake resistant house?
The named barriers can be divided into 8 categories based on similarities: (1) limited financial resources, (2) limited material, (3) limited skilled manpower, (4) limited manpower, (5) lack of water, (6) limited transport, (7) the rules in the government policy and (8) no safe location.

Limited financial resources and limited transport were mentioned in all communities. In general, the economy came out as the most important barrier, being mentioned in all communities and with being voting for it to be most important in 38,5% of the communities by both men and women. The second barrier, limited materials, wasn't mentioned in every community but formed a barrier for 11,7% of the communities. With the third barrier, lack of water (8,9%), the participants said that they had a hard time to make concrete and cement because of the lack of water.

There is a big difference between the two districts when it comes to the barrier lack of water. Okhaldhunga seemed to have mentioned this barriers 37,8% more than Gorkha. Although, the percentage of participants voting on the barrier lack of water is almost the same. Another difference between Gorkha and Okhaldhunga is on the barrier no safe location. Okhaldhunga mentioned this barrier 62,5% and Gorkha 40%. The percentage voted on this barrier is also higher than in Gorkha.

It can be questioned if the offered reconstruction solutions suit the capacities of the communities depending on the materials. According to the outcome of the focus group discussions participants have a hard time getting the 'right materials'. Here for it is important for every NGO to provide the right knowledge on reconstructing an earthquake resistant house that suits the community. For example, a community in Gorkha can build with concrete and bricks but a community in Okhaldhunga might not be able to make concrete. That is why NGOs need to provide the most suitable solutions to reconstruct an earthquake resistant house during their knowledge exchange.

6.3.2 Question 2

What motivated you to build back an earthquake resistant house?
The named motivators can be divided into 10 categories: (1) assistance from government of Nepal, (2) need for safety, (3) the earthquake, (4) advice/help from construction professionals, (5) availability of knowledge to build back safer, (6) assistance from aid organisations, (7) the general need for shelter, (8) access to (drinking) water, (9) access to transport and (10) fear of the blacklist.

Only the government of Nepal was mentioned as a driver in all communities. Overall assistance from the government of Nepal was the main driver with 27% of the votes. The second most important driver is the general need for safety with 15% of the votes. With 12.3% the earthquake itself was voted to be the third most important driver. Participants named the earthquake itself to be a driver to

build back an earthquake resistant house in 69% of the communities. Assistance from construction professionals (6.9%) and availability of knowledge to build back safer (6.7%) were voted to be important too. What is interesting is that 11,5% of the communities mentioned that the fear of the blacklist was a driver to build back an earthquake resistant house. Officially the blacklist does not exist.

There is a difference between Gorkha and Okhaldhunga when it comes to the votes on the motivator. After the top 3 motivators there is a big difference between the two districts. A remarkable difference can be seen in the category advice/help from workers. In Gorkha this came out as the motivator with the least votes. Compared to Okhaldhunga where the advice/help form workers came out as their forth motivator, which is high in the ranking. Gorkha was more affected by the earthquake then Okhaldhunga so Gorkha received more help form the government and NGOs than Okhaldhunga. This might explain why Okhaldhunga finds the advice/help form the local workers more important as a motivator than Gorkha. Another interesting outcome is that the assistance from aid organisations was mostly named in Gorkha (50%) and not in Okhaldhunga (31%). But still the participants were more motivated by the government of Nepal then by the aid organisations.

6.3.3 Question 3

Who helped you to build back an earthquake resistant house?
The named actors can be divided into 9 categories: (1) building construction workers, (2) engineers, (3) government of Nepal, (4) organisations, (5) local authorities, (6) community/neighbours, (7) teachers, (8) family members and (9) myself.

The main trusted actors are the construction professionals (28,5%). This means that the communities put their trust in skilled workers, technicians, contractors and masons. The second trusted actor are the engineers (18,5%). What stands out is that only 50% of the participants mentioned the help of aid organisations. Out of this 50% only 8% voted on this help. The participants don't see the aid organisations to be of great help during the reconstruction because they only need a well-trained construction professional. Here for it is more important for the aid organisations to train these construction actors than the local people.

6.3.4 Question 4

Where did you get the information form on how to build back an earthquake resistant house?
There is a difference the ranking of the technical assistance between Gorkha and Okhaldhunga. The demo house was the main source of information for Gorkha followed by community meetings and door to door. In Okhaldhunga the demo house came out as sixth important source of information. For Okhaldhunga the main source of information were the community meetings followed by the radio, the TV and engineers advice. In Gorkha the TV came out as sixth and the engineers advice came out as ninth important source of information.

Because Okhaldhunga received less technical assistance than Gorkha, the main information sources are community meetings and the radio and TV. Organizations can respond to this by broadcasting their own reconstruction video to help the communities that don't receive that much technical assistance.

6.3.5 Question 5

How do you build an earthquake resistant house?
Okhaldhunga mentioned 87,5% that there was a foundation. This makes a big difference compared to Gorkha, were only 50% mentioned the foundation on their drawings. Also the dept. (3 feet) and the wide (3 feet) of the foundation were 96,9% drawn in Okhaldhunga and only 35% in Gorkha. That the columns are made with steel is also mostly drawn in Okhaldhunga (81,3%) than in Gorkha (50%). Both of the districts have drawn 4 or 5 bands. In Okhaldhunga 100% of the communities did this and in Gorkha 90% of the communities. In Okhaldhunga 100% drawn the bands continuous compared to Gorkha were this percentages was 70%. Another big difference between the districts is the use of material for the roof. In Okhaldhunga 100% drawn the roof with CGI sheets. In Gorkha 60% drawn the houses with CGI sheet, 20% drawn the roof with wood and 20% didn't mentioned the roof type.

There is a difference between the men and women that drawn 4 or 5 bands. Men (88,9%) drawn bands more than women (84,2%). What stands out is that the women (81,3%) mostly drawn the bands continuous instead of men (68,4%). Also 1 door per room is mostly drawn by women (74,6%) than men (59%).

6.4 Outcome structural assessment

The outcome of the structural assessment can be found in this chapter. This chapter is written by Jim de Kort. This chapter is based on appendix 10. The government of Nepal and NGOs have provided certain techniques to build earthquake resistant, but are these techniques understood and applied by the local people?

6.4.1 Foundation

The government set a rule for the measurements of the foundation, 0.6m to 0.9m deep and wide depending on the soil. In Gorkha most of the local people do not apply this rule according to the data. Out of the total 1180 houses is the depth in 233 houses 0.3m and the width also 0.3m in 246 houses. Out of the total 865 houses in Okhaldhunga is the depth 359 times 0.9m and the width in 466 houses 0.9m. This means that Okhaldhunga does apply this rule of the government.

6.4.2 Shape of the house

According to the key messages provided by the government the shape is important during an earthquake, because an unsymmetrical shape will twist during an earthquake causing damage. Therefor shapes as L-shapes and T-shapes are dangerous to build. In Gorkha only 2.5% (1.7% L-shape + 0.8% no usual shape) builds an unsafe shape. In Okhaldhunga it is even less, 1.5% (1.3% L-shape + 0.1% T-shape + 0.1% no usual shape) is building an unsafe shape.

6.4.3 Bands

A most used technique in the designs of the government are bands. In Gorkha 24.0% does not make use of bands, while this is the most important technique because it make the building a solid structure that moves as a whole during an earthquake. Given the fact that a lot of aid was presented in the district the basic techniques such as bands should be applied. In Okhaldhunga the percentage of band usage is higher than in Gorkha which is remarkable because less aid was given in this district, only 16.2% does not make use of bands.

6.4.4 Gable

The key messages of the government explain that it is best to apply a lightweight material gable because a lightweight material gable attracts less force during an earthquake. Smart Shelter Research explains this as well. Wood, bamboo, CGI sheet and tarpaulin are examples of lightweight materials, in Gorkha 61.4% applies a lightweight material gable. In Okhaldhunga this is 72.3%.

6.4.6 Location

According to the data of the structural assessment most of the local people apply most of the techniques in their newly constructed house. But the amount of techniques used does not only determine if a house is safe during an earthquake, the location of the house is important as well according to Smart Shelter Research.

In Gorkha 87.4% of the people are building a freestanding house within the community, this is safe because there is little chance that the building will be damaged by another building according to Smart Shelter Research. In Okhaldhunga only 68.6% of the households are free standing, this is almost 20% less than in Gorkha.

The safest way to build within the environment is to stay at a proper distance from the edge and slope of the mountain according to the key messages spread by the government of Nepal. The distance between the building and the slope of the mountain can be less than the mentioned distance when a retaining wall is applied.

In Gorkha 35.8% is building at a proper distance from the mountain slope, 44.7% builds at a proper distance from the mountain edge, this is means that more than half the questioned people build on a unsafe location within the environment. In Okhaldhunga it is even less than in Gorkha, 15.0% builds at a proper distance of the mountain slope, 24,2% is building at a proper distance of the mountain edge. This means that around 70% of Okhaldhunga has a higher chance to be affected by the environment during an earthquake, such as falling debris, shifting grounds or a landslide.

6.4.7 Overall conclusion structural assessment

Most people in Gorkha and Okhaldhunga use the techniques provided by the government and NGOs, same goes for the location of the house within the communities themselves, but still more than half of Gorkha and about ¾ of Okhaldhunga builds on an unsafe location on the mountain. Counteracting the techniques with the location it is safe to say that around 80% of Gorkha is building safe and around 70% in Okhaldhunga.

6.5 Conclusion

The chapter is written by Gijs van Duren, Sandra van Ekeren and Jim de Kort. It forms the conclusions out of the research methods: household surveys, focus group discussions and structural assessments.

6.5.1 According to the surveys:

- 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.

- 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 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 actually find useful information.
- 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%).
- 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%).
- The participants asked for information by an expert in building (37.4%), someone with more construction knowledge (30.8%) or government officials (33.1%).
- The most reliable sources of information are the radio (25.5%), door to door (27.0%) and engineers' advice (27.0%).
- 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.
- Around 90% of the people applied techniques to construct earthquake or hazard resistant. The most common applied technique is the use of bands.
- The main barrier what limited the people to start reconstructing, is that they have limited money available (55.2%).
- In Gorkha almost everyone feels their house is safe in case of small earthquake (96.5%). In Okhaldhunga this number is a little bit lower namely 82.6%.
- The reason for people to think that their house is not safe in case of a big or small earthquake is that the walls are not strong enough (16.3%).
- A lot of people could make their house safer but are not able to do it.
- If people had more money they would use it, in both districts, for their house (25.5%) and for education (17.6%).

- 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.

6.5.2 According to the focus group discussions:

- The limited financial resources forms the main barrier for people to reconstruct their houses;
- Materials form a barrier, by exchanging suitable solutions as reconstruction materials to build back an earthquake resistant house communities might be able to reduce this problem;
- The lack of water forms a barrier, by providing water sources to communities that experience water needs these communities are able to make their own concrete or cement that is necessary for the reconstruction of their houses;
- The government of Nepal is the main motivation for both districts, collaboration with the government can be of use to reach as many communities as possible to help them reconstruct an earthquake resistant house;
- The participants don't see the aid organisations to be of great help during the reconstruction because they only need a well-trained construction professional. Here for it is more important for the aid organisations to train these construction actors than the local people;
- Because Okhaldhunga received less technical assistance than Gorkha, the main information sources are community meetings and the radio and TV. Organizations can respond to this by broadcasting their own reconstruction video to help the communities that don't receive that much technical assistance.

6.5.3 According to the structural assessments:

- Most of the people in Gorkha don't follow the government rule about the depth and width of the foundation. In Okhaldhunga most of the people do follow this rule;
- In Gorkha only 2.5% builds an unsafe shape. In Okhaldhunga it is even less, 1.5% is building an unsafe shape;
- In Gorkha 24.0% does not make use of bands, while this is the most important technique explained in the received aid. Only 16,2% of the people in Okhaldhunga doesn't use bands;
- In Gorkha 61.4% applies a lightweight material gable. In Okhaldhunga this is 72.3%;
- In Gorkha 87.4% of the people are building a freestanding house within the community. In Okhaldhunga only 68.6% of the households are free standing, this is almost 20% less than in Gorkha;
- In Gorkha 35.8% is building at a proper distance from the mountain slope, 44.7% builds at a proper distance from the mountain edge. In Okhaldhunga it is even less than in Gorkha, 15.0% builds at a proper distance of the mountain slope, 24,2% is building at a proper distance of the mountain edge;
- Counteracting the techniques with the location it is safe to say that around 80% of Gorkha is building safe and around 70% in Okhaldhunga.

7.0 Conclusion

This thesis aims to answer "*What characteristics are recommended for a knowledge exchange support tool that is effective in the support of self-recovery and enables a lasting understanding of hazard-resistant construction principle for the reconstruction process in Nepal?"*

The results of this thesis have shown that for this context, that there are different characteristics that are essential for an effective support of self-recovery processes and that enable a lasting understanding of hazard-resistant construction principles.
The literature review has lead provided recommendations that have been combined in a model in which knowledge is first introduced and exchanged over time to ensure a lasting understanding. Based on these findings it is expected to be crucial to organise meetings in a sequence after the first introduction to enable learners to assist each other in the application of the knowledge. It is recommended to exchange knowledge instead of purely transferring knowledge in order to enable a lasting understanding and adoption.

The experts have recommended that knowledge interventions should use a lot of practical examples and have a short presentation with simple information and the masons should be supported on the construction site in order to successfully enable adoption. There are opportunities to analyse these expert interviews even further and draw additional conclusions from these conversations with other analysis tools such as Atlas.ti. Furthermore, the semi-structured qualitative interview can be used as a basis for further, more quantitative studies into this subject.

The field research in Gorkha and Okhaldhunga has shown that sharing knowledge is especially effective when the knowledge is shared face to face or by a community meeting or through the radio or with the use of a TV. So far, within the timeframe of this graduation study, conclusions have been based on frequencies that came from the different research tools. In further research deeper correlations can be found that could justify and specify the conclusions given here.
Overall this research has resulted in recommendations the are expected to increase the adoption of hazard-resistant construction principles in reconstruction processes after a natural disaster. The recommendation are made for the Nepalese context and can not necessarily be generalized for other situations. However, the literature study and expert input might be relevant for other post-disaster reconstruction situations.

The exact value of these recommendations needs to be tested in practice. It is recommended to test the effectivity of the recommend design of the knowledge intervention in the Nepalese context and optimise. Not all recommended characteristics of the knowledge interventions might be crucial for the enabling of knowledge adoption and some additional factors are expected to be found when conducting field experiments. For further research a longitudinal study is recommended to measure the lasting effect of knowledge interventions. As part of this study preparations have been made for a longitudinal study however, due to practical limitations, this study could not be conducted as part of this thesis. Nevertheless, it is wished for that this thesis is used as a basis for a follow-up field study.

8.0 Reflection

In this chapter there will be retrospected to my graduation process. The GIBBS-model from Graham Gibbs is used to reflect in an objective way. The GIBBS-model is explained in the next chapter. (*P, Mulder*)

GIBBS-model

The GIBBS-model is a reflection model. With this model it is possible to look into the feelings and thoughts during the research process. This model contains six steps, these are the following steps:

1. Description: What happened, objective
2. Feelings: What I think and how I feel about it
3. Evaluation: What went well and what went wrong?
4. Analysis: Lessons learned?
5. Conclusion: What could be different next time?
6. Action plan: What am I going to do differently the next time?

Research reflection

In this chapter the GIBBS-model will be filled in according to the research process.

1. **Description**
   I went to Nepal for 3 months to do my research in the areas Gorkha and Okhaldhunga. In these areas we gathered data by using household surveys, focus group discussions and structural assessments. In the field I talked to a lot of experts and interviewed some of them for some input on my research. I also had the chance to do my case study at Lumanti. Lumanti helped me a lot with my research and they gave me a lot of information.
2. **Feelings**
   I am really happy that I had the chance to do this research in Nepal. The 3 months in Nepal gave me a lot of beautiful experiences. It was really strange to be in a little mountain village without electricity or any phone connection and just be with the local people. It was very difficult to talk with the local people, because of the language barrier. We went back to basic during our field work and because of this I am appreciating the little luxury things so much more than I would ever imagine.
3. **Evaluation**
   It was very difficult to gather the information from so many different data sources in a way with a clear overview. This caused a lot of complications in my thesis. Eventually I could get all the sub-questions clear and I could make connections between the different chapters. To gather the data for each sub-questions went really well, because I got a lot of input from Lumanti and all the experts who I interviewed. There was a good collaboration in our research team. We helped each other with their research if they were facing some problems.
4. **Analysis**
   The next time I would stay closer to my research and I would do less sub-questions. Because in this research I had to gather a lot of different data and needed to analyze all this data. This was very time consuming, and I had to do more work as I expected. The planning of the research was very tight and this caused sometimes a lot of extra late night work.
5. **Conclusion**
   The next time I am going to mark out a clear research target and goal and stay within this. So I can deepen the information for one sub-question and not for 4 different sub-questions. And I would plan less tight, also to have some space left for unexpected work.

6. Action plan

As written above, I would mark out a clear research target and goal and stay within this. I would also choose one sub-question to work out and not 4 different sub-questions. The planning will be less tight, so there would be more space left for unexpected work.

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