Community resilience to climate change in Bangladesh

A case study on a community-based adaptation project from Practical Action

MSc-thesis by Mathilde Twelkemeijer

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A case study on a community-based adaptation project from Practical Action

MSc-Thesis in Environmental Policy submitted in partial fulfilment of the degree of Master of Science in Environmental Sciences at Wageningen University, the Netherlands.

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Abstract

Climate change has become one of the main challenges of the 21st century. While developing countries are least responsible for climate change, these countries are suffering the most from it effects. International non-governmental organizations are partially solving this injustice by setting up projects to help out less developed countries to adapt to climate change. This master thesis examines the effectivity of community-based adaptation projects on the degree of community resilience to climate change in Bangladesh. The reason for choosing Bangladesh as the field of research is because it is evaluated as the number one most vulnerable country to climate change.

A combination of research methods is applied in this master thesis: a case study and a reflection of the case study findings. The case study creates insights into the effects of a community-based adaptation project on a community's resilience to climate change. The case study is performed on the *Disappearing Lands* project which is executed by Practical Action. In order to prove that the effects on the community resilience are related to the implementation of the project, one community involved in the project is compared to a control community. The case study showed that a combination of community resilience and learning processes can make a community more resilient to climate change.

The second research method is a reflection of the case study, in that the findings of the case study are compared to the findings of other community-based adaptation projects from other NGOs in Bangladesh. This reflection showed that not all of the projects focus on community resilience and learning. Moreover, no long-term project evaluation on a community-based adaptation project was found. Therefore, not only a change in project content is recommended, but also the execution of more long-term project evaluations.

Key words: Bangladesh, community-based adaptation project, resilience, learning, long-term project evaluation.

Preface

When I was young, I was always sensitive for charities by being very empathetic, especially when these charities had projects that involved third world countries in desperate need for basic needs such as water, food, sanitation and education. At the age of 16 I worked for a minimum wage of 3 euro an hour while 25% of my income went to these charities. Little did I know that 10 years later I would be examining the resilience of people who were supported by these kinds of charities.

After my Bachelor on Environmental Studies at the University of Utrecht I participated in a summer school from Climate-KIC, which encourages students and professionals to become an entrepreneur in the field of climate mitigation or adaptation. This encouragement involved also financial support to go abroad to get inspired. This financial support indeed encouraged me two years later to go to Bangladesh and perform this research. By this I want to thank Climate-KIC for this wonderful opportunity.

After the summer school I choose to enroll in the Wageningen University for my master's degree in Environmental Sciences. The reasoning behind this change of university is that studying at the Wageningen University would broaden my horizon more with all the different nationalities, among students and professors, present at the university. It did not take long before my interest in other countries started to influence my choices for papers, and it finally also encouraged me to do my internship in the Czech Republic. Since this experience abroad was a very positive one, in which I learned from different cultures, I decided to continue focusing on other countries to do my master thesis on.

After a month of discussing with several professors and many late night talks with my friends about my thesis topic I finally knew what my thesis should be about. Thinking back about my support to several charities I decided to examine the effectiveness of such charities and their projects. I found a wonderful supervisor, Dr. Ingrid Boas. Together we found a great structure and methodology to do my research. During the whole process she supported me, which made me feel less insecure about my ideas and it empowered me to perform my data collection method all the way in Bangladesh. Since she also performed research in countries such as Bangladesh, I felt like I could also talk to her openly about the difficulties I was experiencing, such as power cuts and lack of air conditioning in 40 degrees Celsius. Prof. dr. ir. Arthur Mol assisted dr. Ingrid Boas in supervising me the first months. Not only did he give me great insights in how to execute and write a master thesis, he also enthused me with his encouragements and his positive attitude.

Although my supervisors were of great importance, in Bangladesh I was mostly depended on myself and on the organization Practical Action. At forehand I was very nervous about how it would all turn out. However, all these worries were for nothing; I received a warm welcome of the organization and Faruk Ul-Islam reserved a lot of time for me to talk me through my research details. He personally took care of my transport to the field and accommodation at the field, which made me feel very secure about my fieldwork. Although Faruk Ul-Islam is an extremely busy man, being the Head of the Policy Practice and Programme Development Unit of Practical Action Bangladesh, he treated me and my research very kindly and with deep respect. We got to know each other on a personal level and he even invited me and my family to his home. For that and many other reasons I want to thank him, without him this master thesis would not be completed.

Once at the field the local staff of Practical Action welcomed me to the Gaibandha district. I was accompanied by mister Akkram, who made sure I had everything I needed before starting my fieldwork. He was very patient and helped me the first days at the field. Thanks to him I was not alone my first days in Gaibandha which helped me to settle in this new area. The days after he left other local staff assisted me, many days I was not only assisted by one of the local staff but many of them made sure I had a pleasant fieldwork day. They arranged the transport to the communities, took care of my safety and reminded me on my food intake during the hot days I was in Gaibandha. I still think a lot about the motorbike trips and the places where we had lunch, they probably have no idea what an impression this made on me and I am forever thankful for this real life experience. The ones I want to thank are: Mizanur Rahaman, Jitendra Nath Halder, Saied and Liton (from the last ones I unfortunately do not know the last names). Besides helping me with my fieldwork, they also took me on little trips during weekends which made me feel at home in Gaibandha. All the candy they bought me and the nice lunches they provided me were not only to fill my stomach it also made me realize how kind and generous the people in Bangladesh are. This generosity made me feel very welcome and even loved by people I barely knew. Thank you guys, you made my stay in Gaibandha unforgettable.

The community people are the ones who deserve all the credit for the results of this thesis research. This master thesis would have failed without their contribution. During the interviews they opened up to me and shared their life experiences with me. While I sometimes had the feeling to get emotional when I heard their life stories, they also made me realize how lucky they feel with only having their family and sufficient food to live from. This is something I hope to learn from them, to appreciate all the nice things and all the opportunities I have in my life. I wish the people I spoke to in the communities all the best and hopefully one day I can come back to their communities and return the favor.

Besides the local staff and the community inhabitants I also made friends with the GUK hostel staff and a woman I met on the streets named Keya. The hostel staff took care of me and was concerned when I was sick, this sincere concern was very sweet and I want to thank them for everything they did for me. My new friend Keya taught me that real friends do not have to say thank you for everything they do for each other. Therefore, I will say nothing to honor her lesson.

Ending up in Bangladesh would not have been possible without one person who showed the meaning of hospitality. This person is Afsana Parven who, with her good heart, trusted me to stay with her family in Bangladesh. She and her family treated me like I was one of them and I received all the love a real family member would receive. Her sisters guided me through the city and her daughter, nephews and nieces thought me how to count in Bangla. Afsana's mother took care of me and made sure I had everything I needed. I could write pages about my adventures with Afsana's family but all I can say that I am extremely grateful for letting me be a part of their family.

Although I was often surrounded by good and friendly people in Bangladesh, the culture shock and some lows in my fieldwork could not have been avoided. In these times I could always depend on my friends in The Netherlands, who were only a skype call away. They inspired me to go through with my fieldwork and to follow my instinct. No words can describe how great it felt to have this kind of

support no matter where you are in the world. The one who was especially very supporting was my boyfriend Jan, he was there day and night just to listen to me and to let me share my worries with him. After sharing my worries I felt relieved and could continue with my fieldwork or finally fall asleep during a hot night in Bangladesh.

After my Bangladesh experience I had to write my thesis, which is quite challenging for me as writing is not my strong suite. Two persons helped me with this. The first is a friend of my father whom also helped me getting through my language courses at high school. Even after I graduated seven years ago from high school, partly thanks to his lessons, he again helped me with improving my writing. Thank you Marcel Zwart. The second person is person is my new rugby teammate Lou whom offered me to through my thesis to do a final check, thank you Lou!

Finally I want to thank my family. I think my sister does not know this, but she always inspires me to follow my instinct and to do whatever I want to do. Since she is a great example of being spontaneous and living your life to the fullest, I followed her lead and have not regretted it for one moment. Thank you for being you Simone. My parents have always been supporting me and my choices in my life, but with my choice to go to Bangladesh their support was more than ever. Especially my father encouraged me to go and he even decided to come and visit me. My mother was more protective and was at first not such a great fan of my plan to go to Bangladesh. However, my mother joined my father and visited me as well in Bangladesh. Not only was it great to be with my parents in such a strange country, it also made me feel really special that they traveled so far just to visit me. Although we had some lows and although Bangladesh was much less developed than my parents expected, I am very grateful that they visited me. And it could not have been a better choice to visit me and made me feel loved in a country which is all about being with your family.

With this in mind I hope you enjoy reading my thesis.

Mathilde Twelkemeijer

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Abbreviations

IPCC – International Panel on Climate Change
NGOs – Non-governmental organizations
NGO – Non-governmental organization
BCCASP – Bangladesh' Climate Change Strategy and Action Plan
PADev - Participatory Assessment of Development
UST - Unnayan Shohajogy Team
RDRS - Rangpur Dinajpur Rural Service
ESDO - Eco-Social Development Organization
WFP - World Food Programme

1. Introduction

Climate change has become one of the main challenges of the 21st century. It is both an enduring and complex hazard which has different effects, from drought to floods, and is multidimensional, from local to global. Moreover, climate change is a hazard that has short- and long-term effects with unknown outcomes (O'Brien et al. 2006). Due to these unknown outcomes, we are uncertain about the future of our climate. The International Panel on Climate Change (IPCC) aims to reduce this uncertainty by creating a scientific overview of climate change research. The IPCC report of 2014 concludes that the cumulative emissions of CO2 largely determine global surface warming by the late 21st century and beyond. Adding on to that, IPCC 2014 claims that it is very likely that the magnitude and incidences of extreme high sea level will increase and that the frequency and the amount of heavy precipitation, and intensity of the precipitation are also likely to increase. These changes entail that also the contrast between wet and dry seasons is likely to increase.

These climate change effects mostly occur in the developing countries, which create an injustice, because less developed countries are least responsible for climate change, and thus most vulnerable to its effects (Adger et al. 2003). In contrast to that, the developed countries, which have contributed the most to climate change, are less vulnerable to its effects. Therefore these countries are more likely to cope better with these climate change effects (IPCC 2001, pp.84) than less developed countries that often have lower adaptive capacities due to technological, financial and governmental constraints (IPCC 2001, pp.84).

It is interesting to examine how this injustice is partly solved by non-governmental organizations (NGOs), which set up projects to help out less developed countries to adapt to climate change. These projects focus on climate adaptation on a community level and are classified as community-based adaptation projects. This master thesis aims to examine the effectiveness of such projects by evaluating the degree of a community's resilience after being part of a community-based adaptation project.

Community resilience is a holistic approach to reduce a community's vulnerability to climate change. Resilience is "The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions" (IPCC 2012, pp.3). The degree of community resilience thus gives a complete overview of the preparedness and the adaptability of a community to climate change. It is therefore important that the community-based adaptation projects from NGOs in rural areas improve the degree of community resilience.

In the past, community-based adaptation projects, categorized as development projects, were criticized due to their disappointing results. One of the overruling arguments was that the development projects are in need of more bottom-up instead of top-down strategies, meaning that the beneficiaries should be more involved in the process of the project. And in order to create real development, beneficiaries should be involved in their own improvement. Finsterbusch & Van Wicklin (1987) confirmed that participation has an intrinsic value, since people do not develop

without participation. Participation can be increased by involving a community in a project process and by enabling the community to find its own structure in what has been learned. Besides increasing the participation of a project's participants there should be linkages between the hazards, risks and the livelihoods entailing activities to manage the natural resources and watershed or to generate more income and to reduce poverty.

In order to capture all of the above, a community-based adaptation project should be evaluated on its effects on the degree of community resilience to climate change. Moreover, the effects of these community-based adaptation projects on the community resilience to climate change should include long-term effects, as the community's inhabitants need to be prepared for the short-term effects of climate change as well as the long-term effects of climate change. Next to that, the inhabitants should be able to improve their own adaptability in the future because climate change effects are uncertain. Short-term effects of the community-based project on the community resilience to climate change are therefore less relevant than long-term effects. However, some projects do not seem to achieve effects on the long term, which could be regarded as a wasted effort since these projects will not help people living in rural communities to become more resilient to climate change effects in the future.

This ineffectiveness of some projects can be prevented by increasing one particular community resilience concept, namely learning. Learning causes people to improve themselves. Learning how to make an action more efficient or how to change a lifestyle to become more effective and in turn adapt better to climate change, is essential for creating long-term community resilience. Therefore, implementing learning skills, enhances the effectiveness of a project. Due to the vulnerability of developing countries to cyclones, floods and other disasters, it is useful for the inhabitants to learn how to deal with climate change and its associated disasters.

This master thesis examines the effectivity of community-based adaptation projects on the degree of the community resilience to climate change in Bangladesh. The reason for choosing Bangladesh as the field of research is because it is evaluated as the number one most vulnerable country to climate change (Maplecroft 2014). This makes Bangladesh a useful benchmark for other vulnerable countries and therefore an interesting field of research. This master thesis specifically focuses on the rural areas of Bangladesh, since these areas are extra vulnerable to climate change effects due to the fact that the inhabitants have a lower and less secure income. Community-based adaptation projects support the rural people in less developed countries to increase their adaptive capacity to survive climate change.

This chapter introduces the climate change problems the inhabitants of Bangladesh face, including the future problems that will occur due to climate change. After this introduction of problems, the research aim and research questions are described, followed by a short overview of the methodology that helped to answer this research question. Finally, an overview of the aim of the following chapters of this master thesis is provided.

1.1 Bangladesh: number one most vulnerable country

Bangladesh is chosen as this thesis' research field because of its extreme vulnerable location with regard to the effects of climate change. The inhabitants of Bangladesh are exposed to a high

biophysical risk, which refers to risks with a natural origin (Füssel 2007). They are living in an unstable river delta and face floods during the monsoon. Besides the biophysical risks, the inhabitants of Bangladesh are also vulnerable because of the country's relatively short existence, which causes development problems. The latter makes people living in Bangladesh also socially vulnerable.

The biophysical vulnerability of the inhabitants of Bangladesh is currently increasing due to climate change. Bangladesh will suffer in the future from physical impacts of more extreme and frequent climate-related events, such as intense storms, drought or flooding (Maplecroft 2014). Nearly all the sectors of the socio-economic lives in Bangladesh are likely to be affected by climate change (Ali 1999).

Bangladesh is a highly vulnerable country as it is densely populated and low-lying, located on the Bay of Bengal in the delta of the three large rivers Ganges, Meghna and Brahmaputra (Karim et al. 1998). Projections of rainfall in 2050 are -67% (pre-monsoon), +35% (monsoon), -12% (post-monsoon) and +107% (winter). This means that the wet seasons are getting wetter and the dry seasons are getting dryer. The driest region in Bangladesh will be the northwestern region (Rahman et al. 2012).

Most of Bangladesh' climate change impacts are likely to come from the south; from the Bay of Bengal and the nearby north Indian Ocean (Ali 1999). These seas are the sources of tropical cyclones, coastal erosion, monsoon wind, droughts and floods. Moreover, river erosion is becoming more severe as well. Bangladesh has one of the world largest deltas with 230 rivers which are considered to be the most unstable in the world (Gregory 2009). The delta has been presented by the Delta Alliance (2010) as the least sustainable delta of the world due to different pressures such as environmental degradation, high population density and vulnerability to natural hazards such as flooding, droughts and salinization. And due to climate change this process is accelerated.

The rivers of this delta have their origin in the Himalayas where the population of Nepal and China is rapidly changing to keep fulfilling their needs. In the early 90's scientists discovered the change in hydrological systems in the basin of the Ganga and Brahmaputra, which both debouch in Bangladesh. According to these scientists the activities of the population cause severe floods and extreme droughts due to the following feedback system: population growth in the Himalaya mountains → increased demand for fuel wood, timber and fodder → uncontrolled forest removal in marginal areas → intensified river erosion and peak flows → siltation and severe flooding on the densely populated and cultivated plains of the Ganga and Brahmaputra, which are located in Bangladesh (Hofer & Bruno 2006). Adding on to that, climate change will create more heavy rainfall and extreme droughts and causing this feedback system to become even more intense.

The shifts in river courses in Bangladesh are unpredictable. More than one million people are affected annually by these shifts and around 100.000 people are annually forced to relocate as their villages are suddenly washed away. Besides that, the monsoon season causes a flood which covers up to one third of the country. This, together with river erosion, causes people to migrate to embankments or urban areas (Gregory 2009). Therefore this highly overpopulated Bangladesh faces major climate adaptation problems in the near future.

One of the reasons for the social vulnerability of people living in Bangladesh is the country's short existence. Since Bangladesh became independent in 1972, the country is still trying to find a way to implement a sustainable regime. The reason for this, is their weak governance (Pramanik 2002). In its rise to independence many current inhabitants of Bangladesh, or relatives, fought a war in which famine and diseases cost many lives. Nowadays, power struggles and corruption are daily problems the inhabitants of Bangladesh have to face. According to many locals I spoke to, the power struggles often lead to dangerous political situations in which the opposition party threatens to abduct or even kill members of the leading party. Besides local knowledge, little sources of information about these activities are available. During my stay, I experienced these power struggles when I could not do the interviews I planned to do because of demonstrations of one party to demand the liberation of its party members which were abducted or held in captivity by other parties. These problematic activities may happen behind closed doors, however, could also distract politicians from guiding the country towards a more sustainable society.

Although Bangladesh is proud to be one of the few democratic countries with a Muslim majority, corruption often overrules the democratic structure. One of the most violent elections in the country's history was in January 2014, which was won by the ruling party, spoiled by low turnout, street fighting and a boycott by the opposition (The Washington Post 2014). This situation, which causes slow development in Bangladesh, almost caused this research to be canceled. However, thanks to the connections I had in Bangladesh, I was able to continue my research safely.

However, despite the political situation, Bangladesh does make steps towards a more resilient Bangladesh. Bangladesh has developed a cyclone preparedness programme to minimize the damage and loss of lives by strengthening the capacity in disaster management (Cyclone Preparedness Programme 2011). And with the support of the United Nations Bangladesh improved its early warning system with technical advances on weather and flood forecasting, monsoon modelling and pre-impact assessment tool development (UN 2013). Moreover, Bangladesh launched its first Climate Change Strategy and Action Plan to enhance resilience to climate change and to facilitate sustainable growth. In a response to this, a trust fund for climate change was proposed to support Bangladesh with this plan, which became reality in 2010 when the Bangladesh Climate Change Resilience Fund was established.

Although these implementations and action plans have a positive effect on the reaction time to natural disasters, more work needs to be done to make local people less vulnerable. Because of their vulnerability to climate change, people tend to migrate to urban areas, which are already highly overpopulated. In order to reduce the migration to urban areas, the livelihoods of the rural population must be improved (Shikdar 2012). However, implementations to adapt to climate change are costly and therefore not always in place in the rural areas of Bangladesh.

1.2 Research aim and research question

The aim of this master thesis is to examine the effect of community-based adaptation projects on the long-term resilience of communities in Bangladesh. The study focuses on the way the community's inhabitants learn how to cope with climate change, how this learning affects their degree of resilience and how the community as a whole becomes more resilient to climate change. With this master thesis I aim to contribute to the methodology of community-based adaptation projects and

the methodology on the way a community-based adaptation project can be evaluated. Moreover, I aim to contribute to the scientific field of resilience by providing insights into how to combine two types of resilience components, namely community resilience and learning.

The research question of this master thesis is as follows:

'In what manner and to which extent do community-based adaptation projects of NGOs in Bangladesh improve the long-term community resilience to climate change?'

1.3 Methodology in short

To answer this research question a combination of research methods is applied. The first research method is a case study, which is used to create an insight into the effects of a community-based adaptation project on the community resilience to climate change. This case study is a project evaluation of the project *Disappearing Lands* from Practical Action, which is described in more detail below. To exclude effects which do not originate from the project, a comparison with a control community is made. This control community has never been involved in any project. The second research method is a comparison between this project evaluation and other project evaluations of community-based adaptation projects from other NGOs in Bangladesh. This comparison is made to find similarities and differences in the effects of the community-based adaptation projects on the community resilience to climate change.

1.3.1 The case study: *Disappearing Lands* Project from Practical action

The case study is a comparison of two communities which are both located in the Gaibandha district of Bangladesh. This district is located in the northwest of Bangladesh, where river erosion causes people to flee from their communities to the embankments. In these embankments they have to start their lives without any resources, and are positioned at the bottom of the social ladder. The NGO Practical Action is active in these areas and supports the relatively very poor people in communities to become resilient to climate change.

Practical Action is an international NGO which has a local office in Bangladesh. Their work in Bangladesh has developed to meet the challenges of inequality, poverty and vulnerability. By implementing appropriate sustainable technology they aim to improve the livelihoods of the poor. These livelihoods are improved by listening to the needs of the poor and responding to local conditions (Practical Action s.a.a).

Projects of Practical Action are focused on preparing local people for the upcoming, and currently happening, local environmental problems. Most of the projects focus on resilience to climate change (Practical Action s.a.b) or on factors that can make a community more resilient to climate change, such as disaster management, food security, pathways from poverty and coping with river erosion (Practical Action s.a.b). Coping with river erosion is highly significant in Bangladesh and therefore a project of this kind is evaluated in this thesis.

The evaluated project's name is *Disappearing Lands* project and it is categorized as a river erosion project (REP). The project improved many lives that were uncertain or affected by river erosion. Some project participants were chosen from the embankment communities as being the relatively very poor. In the past they had to flee from their original community as the river eroded and took

their community away. The project provided a new community and livelihood options for these people. The latter happened to the people now living in the community Sreepur, which will be the project community of the case study.

1.4 How-to-read

This first chapter introduced the key determinants of this research: climate change, climate change adaptation, resilience to climate change and the vulnerability of Bangladesh. Next to that, the research aim and research question are explained and the methodology is introduced.

The second chapter, the theoretical framework, creates a framework of theories used for the evaluation of community resilience to climate change in Bangladesh. In this framework, I focus on two key concepts of community resilience to climate change in particular, namely community resilience and learning.

In the third chapter, the methodology of the case study is explained. It explains how the project evaluation is performed by comparing the project community with the control community. The methodology of the reflection on the findings from the case study, the generalization, is also explained in this chapter.

The fourth chapter applies the theoretical framework to the case study. This project evaluation shows which project elements caused which kind of community resilience or learning. In doing so, it shows in what manner and to which extent a community-based adaptation project can influence the degree of community resilience to climate change.

The fifth chapter is a reflection on the key results of the case study. This chapter reflects on the results in two ways. One reflection is based on the difference between the long-term results, which are the results of this thesis, and the short-term results, which were identified by two kind of evaluators in 2009. The second reflection is based on other long-term project evaluations on community resilience to climate change from other NGOs in Bangladesh. This reflections indicates which results are general within climate adaptation projects in Bangladesh and which results of the Practical Action methodology are unique. Finally, common methods and results amongst the community-based adaptation projects in Bangladesh are also presented in this chapter.

Finally, a conclusion is made based on the former chapter. This conclusion provides an answer to the research question. And additionally, it discusses the contribution of this master thesis and puts forward the recommendations based on this study.

2. Theoretical Framework: Community resilience to climate change

This chapter develops a theoretical framework to examine community resilience to climate change. Community resilience to climate change is a concept which is used in this thesis to evaluate a project from Practical Action. The focus is on two components of community resilience to climate change, namely community resilience and learning. The way the project evaluation is executed is described in chapter three on methodology.

This chapter starts by analyzing the history of the concept resilience in order to provide an insight into how resilience has evolved. In the same section the definition of resilience are discussed. The level of research is also explained, which is simultaneously the first component of community resilience to climate change: community resilience.

In the following section the second key concept is described, namely learning. Since this key concept can be divided into four 'loops', there are four subsections: zero learning, single loop learning, double loop learning and triple loop learning.

At the end of this chapter an operationalization of these two key concepts, community resilience and learning, is provided. This operationalization creates a clear framework for the project evaluation in chapter four.

2.1 Development of the resilience concept

Resilience theory was established in the early seventies as a theory on ecological stability by Holling in 1973. Resilience emerged from ecology studies on the interacting populations, like predator and prey, and their responses concerning the ecological stability theory (Holling 1961; Rozenzweig 1971; May 1972). It was introduced as a concept to understand the capacity of ecosystems with alternate attractors that persisted by staying in the original state (Gunderson 2000; Folke 2006; Scheffer 2009). Holling studied the effects of random events, such as the effects of climate change, on natural systems which could lead to a change in the domain of the system. He wrote a paper on the existence of multiple stability domains in natural systems and how they relate to these random events (Holling 1973). In his paper he introduced resilience as the capability of a system to persist within such domain while undergoing change. He proposed that "resilience determines the persistence of relationships within a system and is a measure of the ability of these systems to absorb changes of state variables, driving variables, and parameters, and still persist" (Holling 1973, p.17).

The term persistence is the degree to which a person can persist in doing an action or a routine. The term is used very often in ecological resilience studies. In socio-ecological systems the disturbance is more positively put as a chance to do new things, innovate and develop (Adger 2006). Socio-ecological resilience views natural and human systems as interdependent, which is true on both local and global levels; local communities and their surrounding ecosystems and human activities on earth cause issues such as climate change (Steffen et al. 2007). Because of that, it is irrational to continue to separate social and ecological resilience.

Social change is important for socio-ecological resilience. In addition, to make social change possible, a high extent of adaptability and transformability is necessary. Adaptability is the capacity to learn

how to adjust to changing external and internal processes by combining experience and knowledge, while developing within the current stability domain (Berkes 2007). Adaptive capacity is the capacity of actors in a system to influence resilience (Folke et al. 2010, pp.3), which allows for continuous development; an adaptive interplay between sustaining and developing within changing circumstances. While adaptive capacity maintains certain processes under internal and external changes, transformability creates a fundamentally new system with new processes. According to Walker et al. (2004), transformability is "The capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable" (Walker et al. 2004, pp. 3). When economic, social or ecological structures create an untenable system the capacity to transform should be high (Walker et al. 2004).

Westley et al. (2006) argue that resilience is not about this balance between transformation and persistence. Instead, they claim resilience shows how transformation and persistence collaborate, allowing systems to process disturbance, innovate and transform, while maintaining characteristic procedures and structures (Westley et al. 2006). This argument shows similarities with the terminology of adaptability, which means making adjustments while staying in the current stability domain.

2.1.1 Resilience to climate change

Resilience is applied to two different scales of problems. The first is called specified resilience and refers to a problem on a particular aspect of a system which arises from a particular set of shocks or sources. The second is called general resilience and refers to all kinds of sources or shocks that can disturb the system in many ways, including completely new sources or shocks (Folke et al. 2010). In this master thesis the problem is climate change. This problem knows many shocks and can disturb a system in many ways. And since different factors of the society create climate change, the source is also multiple. Problems in Bangladesh, such as poverty, oppression of women, job security and starvation, are also influenced by climate change, either directly or indirectly. Resilience to climate change is therefore a general resilience that refers to a problem that creates multiple kinds of shocks and has multiple kinds of sources, which can disturb the system in many ways.

Specified resilience arises in response to the question 'resilience of what, to what?' (Carpenter et al. 2001). However, by focusing on specified resilience, there is a danger in becoming too focused because increasing resilience of the specified part of a system to the specific disturbances can create a decrease of resilience in other ways (Cifdaloz et al. 2010). For example, by focusing on starvation the quality of the education system can be neglected. In this thesis, the focus of resilience to climate change is general resilience as the inhabitants of the community are also vulnerable to health problems and starvation. Health problems and starvation can, in their turn, make the inhabitants of the community more vulnerable to the effects of climate change. For example, when a person becomes ill, it needs to have a good nutrition to survive. However, when an extreme drought causes the person to have no sufficient water intake, the illness can become fatal. By not only evaluating the direct climate change effects and reactions but also taking into account the indirect influences of climate change, this thesis research aims to evaluate communities' general resilience.

As discussed in the introduction, the direct effects of climate change are an increase in average weather temperatures and more extreme hot days and cold shocks. Furthermore, there are more

extreme rainfall cycles, with less rainfall when it is most needed in the dry season and more rainfall during the monsoon. The combination of a higher temperature and the increased quantity of rainfall during the monsoon will cause more and more extreme floods. More powerful tornadoes and cyclones will also effect Bangladesh, however, these mostly occur in the areas where the Bay of Bengal touches upon the land (Pender 2008).

This master thesis also takes into account the indirect effects of climate change. The indirect effects are the effects of the climate change effects. One of the indirect effects, which affects the case study of this master thesis, is a higher quantity of river erosion cases, because rivers receive more pressure from the higher quantities of water during the monsoon. More river erosion cases also result in more people fleeing from their community to the embankments or to urban areas, which causes more densely populated areas. Another kind of indirect effect, which affects the case study, is the lack of transport and communication due to the more extreme and extended floods. This could affect social connections and as a result the resilience to other effects of climate change. However, water is not only a threat, but also a loss during the drought period. This creates another indirect effect on the case study, since drought obstructs the cultivation of agricultural land.

The indirect and direct effects show that climate change is a problem which can be adapted by increasing the general resilience type, and therefore, there is the need for a holistic approach. The indirect effects are also considered in the project evaluation, which is explained in the next chapter. In the fourth chapter the execution of the project evaluation is described.

2.1.2 Community resilience

This master thesis examines resilience on the community level, in which community resilience is one of the two components of community resilience to climate change. In this study, a community is defined as an entity that has geographic boundaries and a shared fate. Within these geographic boundaries a community is composed of natural, built, social, and economic environments that react to another in a complex way (Norris et al. 2007). At a community level, a disturbance in the system, in this case climate change, can have a perceived low or high impact. When a community perceives the disturbance as an upcoming high risk, the resilience of a community is dependent on the following variables: coping style, self-efficacy and the sense of community (Paton & Johnston 2001).

The coping style influences the response to climate change. This can be categorized in problem-focused coping and emotion focused coping. Problem-focused coping is confronting the problem, which is a mechanism to facilitate resilience. Emotion-focused coping is denying or suppressing emotional reactions without attempting to tackle the problem, this kind of coping often increases the vulnerability (Bachrach & Zautra 1985; Millar et al. 1999; Yates et al. 1999).

Self-efficacy is an individual's estimation of what its capable of performing. This influences people's openness to information and the probability to act and deal with the consequences of climate change (Bachrach & Zautra 1985; Yates et al. 1999). The perceived self-efficacy is regarding people's beliefs in their capability to influence events or disturbances which affect their lives. When people do not believe that there action can produce the desired effect, they have little motivation to undertake activities (Bandura 2010). This means, regarding to climate change, that people will not undertake

action to solve the problems which are created by climate change, unless they believe their actions can create a more desirable effect.

The sense of community consists of the community inhabitants' sense of belonging and their attachment for places and people. This enhances the involvement in community's response to climate change. With a high sense of community the community has an increased utilization of social networks. Individuals who experience a low sense of belonging often feel detached and during disasters isolated and helpless. This feeling is caused by little, or nonexistent, investment in the community. When the sense of community is perceived overall high the level of support during disasters will likely be high, moreover climate mitigation strategies are more in place in such communities (Paton & Johnston 2001). The sense of community can be created through identifying the community by the community inhabitants. For individuals this means to consider "who your community is and which communities you belong to" (CO, 2011b, p.9). This is in line with Paton & Johnston (2001) and according to Bulley (2013) this sense of belonging is producing a community by generating affective ties.

Another factor of the sense of community is the expression of the community inhabitants that communicates to others that they belong to the particular community (Cabinet Office 2011a). Buildings that resemble the community, and which can solely be used by community members, also increases the sense of community. Besides that these buildings express to outsiders that this is a community and thereby people living in the community feel a sense of belonging. These buildings create attachment, which increases the sense of community. Activities in such buildings, or activities outside these buildings, such as meetings and gatherings can also enhance the sense of belonging, since these meetings and gatherings strengthen the relationships among the community inhabitants. Relationships among the community inhabitants create attachment to people, which increases the sense of community. When there is no sense of belonging a community cannot be recognized as people doubt its identity or existence.

Moreover, the sense of community can be increased by a high resource equity among the community inhabitants (Norris et al. 2008). In case of a high resource equity, people are most likely willing to help each other in times of disasters. Adding on to this Adger (2000) claims that communities with a broad range of resources are more able to cope with change, which depletes one resource, than a community which has a high resource dependency on one resource. Therefore, a community should have inhabitants with multiple resources and thereby a high resource equity.

When climate change occurs the relatively rich, with a high resource equity, should take care of the relatively poor inhabitants. The relatively poor inhabitants are the vulnerable people in the community. Other kinds of vulnerable people are mostly the ones who have limited mobility, like the oldest, or those who recently had an operation or are physically disabled and the ones who are mentally disabled and might find emergency instructions difficult to understand (Cabinet Office 2011b). But Cutter et al. (2003) claims that the socio-economic status mostly defines if you are vulnerable or not. In this master thesis I define vulnerable people as people whom are relatively very poor and or are physically disabled.

To structure the community and to make sure that the vulnerable people make it more easily through more extreme droughts and floods, due to climate change, a community leader and a volunteer committee can be established. The community leader must be a person who is trusted and has an organizational, coordinating and inspiring role as this person needs to keep the people in the community motivated to keep them involved in becoming more resilient. However, such a hierarchal system also has its downsides as people are becoming followers instead of innovative and free minded. Therefore the volunteer committee is also involved in leading the community. The volunteers are the ones who are willing and able to help others during emergencies, these others could be the vulnerable people of the community who are not capable of rescuing themselves (Cabinet Office 2011a). These volunteers also create another attachment as people in the community feel attached to these volunteers, the same goes for the community leader. Additional to helping the people in their own community, the volunteer committee also help out other communities in times of need. To enhance the sense of community, all the community inhabitants should vote for the community leader position and the volunteer committee positions.

2.2 Learning

This master thesis examines two components of community resilience to climate change, one component is community resilience, which is described above, another component is learning, which is described in this section. Learning is a part of community resilience and describes the resilience on a personal level. A community is resilient to climate change when it has, besides a high degree of community resilience, inhabitants with a high degree of resilience. In this master thesis I refer to a resilient person, as someone who has the ability to learn to cope with climate change.

This component is important since the inhabitants of the community can improve themselves by learning from their mistakes. Learning is also a component which creates a long-term effect, when someone is able to learn from their mistakes they will repeat this learning in the long term. When people are learning they are self-organized as they are adapting independently, they are dealing with the problem and having a high self-efficacy. To which extent they are learning reflects the difference between persistence, adaptability and transformability, as described earlier. This difference relates to the degree to which a person is able to change its action, frames or context to cope with climate change. With being persistence the lowest degree of changing, adaptability the improved degree of changing and transformability the optimal degree of changing in order to cope with climate change.

In 1974, Argyris and Schön provided deeply influential insights to individual and organizational learning. They argued the behavior of people is guided by their ‘theories of action’. Argyris and Schön (1974) propose two types of theories of action: espoused theories and theories-in-use. The first one is what the person believes it would do in a particular situation and the second one is what the person actually does. People’s actions are often ruled by their unaware theories-in-use which differ from the values and beliefs which they aim life by; espoused theory.

Argyris and Schön (1974) perceive learning as the formation or modification of a theory-in-use to meet with their espoused theories. This means that people change their action to create more similarities between what they believe they do, espoused theory, and what they actually do, theories in use.

Learning also occurs when an action has unintended results. Unintended results are an outcome of an action which was not foreseen and not the aim of the executed action. When there is a mismatch between the intention and the outcome, the consequences are unintended (Argyris and Schön 1978). For example, if the harvest fails while the farmer has put effort into the cultivation of his land, the outcomes are unintended.

Two responses to unintended results are suggested by Argyris and Schön (1978) which involves different kinds of learning; single loop learning and double loop learning (Smith 2001, 2013). However, Keen et al. (2005) suggests that there is also a triple loop. This learning loop framework contains tree loops, which are divided on the extent to which the learning process promotes transformational change. This framework integrates concepts such as action-oriented problem-solving, concrete learning cycles, learning-by-doing which come from experiential learning (Kolb 1984) and transformative learning (Mezirow 1995).

Different scientists have been exploring these loops and in total there are four kinds of 'loops' which reflect effectiveness of learning, with one of them having no loop at all:

- Zero learning;
- Single loop learning;
- Double loop learning and;
- Triple loop learning.

(Argyris and Schön 1978; Georges et al. 1999; Armitage et al. 2008)

Learning takes place during the errors of people's actions and routines, therefore learning can be seen as a personal development. The extent to which a person reacts on this error and tries to fix the situation is equal to the personal learning process. The errors on which this thesis is focusing on are related to the effects of climate change. Climate change can therefore be seen as the stressor that forces people to go through a learning loop. The effects of climate change in Bangladesh are extreme droughts, floods and cyclones. These effects influence the actions and routines related to people's livelihood; income, housing, social connections, infrastructure and health. As climate change is influences the basic needs of community people in Bangladesh it is highly important to be able to learn to cope with climate change.

In this section each learning loop is described: Zero learning, single loop learning, double loop learning and triple loop learning. The learning loops are explained on the basis of figure 1. This figure is used by the IPCC in their SREX 2012 report to show which learning loop interferes at which level: action level, framework level and context level. It shows that single loop learning is a kind of reaction on the outcomes, whereby a person reacts through changing the action. Double loop learning is also a reaction of the outcomes, however, it does not solely look at the action but also to the frame. A person going through double loop learning is reframing the action to improve the outcomes. Triple loop learning goes a step further by reacting on the outcomes through transforming the action. A person going through triple loop learning changes the contexts of the frames of the action to improve the outcomes.

The methodology chapter operationalizes the learning loops, so that they can be detected in the case study conducted in this master thesis.

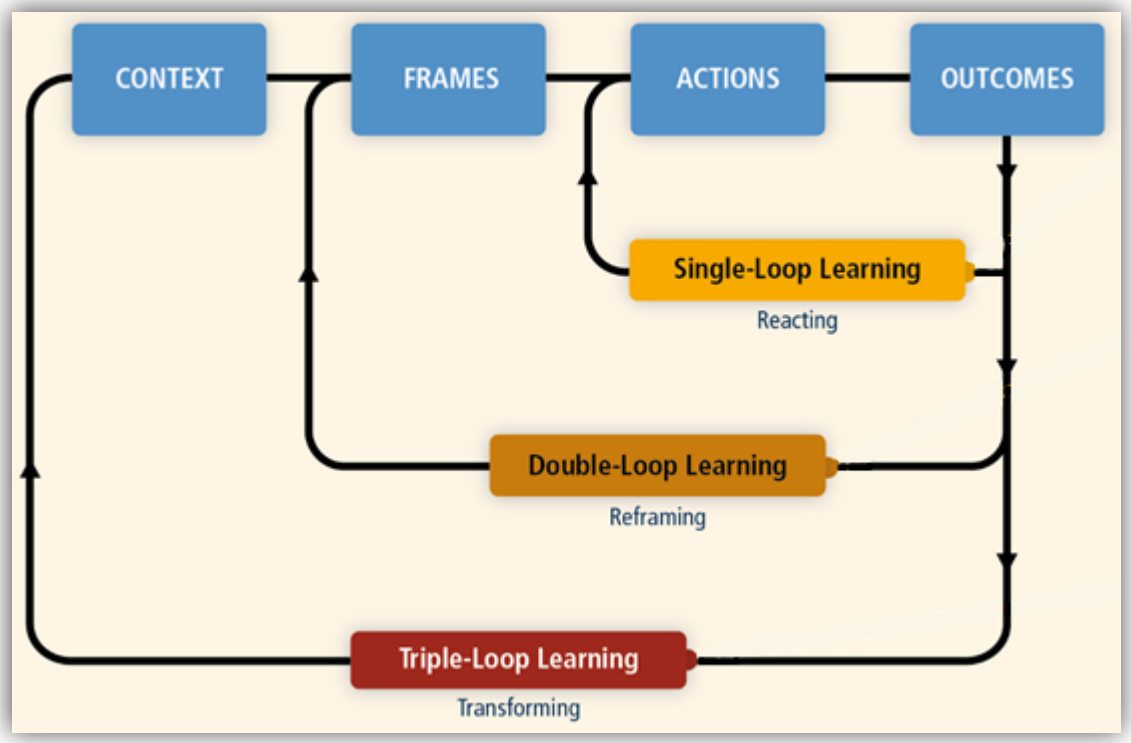

Figure 1: Learning loops and their interference on each level. Adapted from IPCC (2012).

2.2.1 Zero learning

It is possible to go through no learning loop after an error in the action or routine takes place. This so called 'zero learning' occurs when new problems or imperatives arise, yet people fail to correct their action (Georges et al. 1999). This could be seen as an ignorance of the problem or feeling hopeless. Ignorance can occur when problems happen for the very first time and hopeless situations are created when these new problems start to occur more often and people do not feel they have the power to correct their action and thereby solve the problem.

It can be argued that zero learning is a kind of persistence, which is described earlier. People persist to repeat their actions because of a lack of an evaluation of the result or due to their hopeless situation. Persistence is the degree in which a person can persist in doing its action or routine. When the outcomes of an action are life threatening a person should make changes to the action to be able to persist in doing the action. Therefore persistence is not used to define zero learning in this master thesis.

2.2.2 Single loop learning

Single loop learning occurs, following the organizational theory[1], when error detection "permits the organization to carry on its present policies or to achieve its present objectives" (Argyris & Schön 1978, p.2). In other words single loop learning occurs when an action fails and by changing the action

[1] Argyris and Schön (1978) were creating these loops with a focus on organizational learning, when seeing a community as an organized unit of individuals this theory can be applied.

the purpose or tools to execute the action are not changed. It is like a thermostat that learns when it is too hot or too cold and turns the heat on or off. The thermostat can perform this task because it can receive information, which is the temperature of the room, and take corrective action (Argyris & Schön 1978).

In single loop learning changes are made based on differences between what is anticipated and what is observed. This type of learning is focused on improving the efficiency of an action (Pelling et al. 2008). According to Argyris and Schön (1978) single loop learning refers to routine or ad hoc learning and the people who go through single loop learning search for other means to achieve the same end (Argyris et al. 1985). According to Armitage et al. (2008) single-loop learning allows correcting mistakes or improving the outcomes.

Regarding the earlier discussion on persistence, adaptability and transformability, single loop learning can be defined as persistence. Since people going through single loop learning are adapting while persisting to stay in their stability domain. This stability domain can be seen as a domain in which actions can change without changing the frame of the action (figure 1). The frames are the underlying thoughts of an action, which could be policies, social rules etc.

People go through single loop learning when values, goals, frameworks and often strategies are taken for granted. In this case they want to make the strategy of the action more effective and the emphasizes is therefore on making the techniques more efficient (Usher and Bryant 1989, pp. 87). To explain these learning loops the IPCC (2012) created an example for flood management, which is also used to in this master thesis to make the learning loops less abstract. The example in flood management for single loop learning is when floodwater threatens to break through flood defenses, flood managers may ask whether the dike heights are sufficient enough and make adjustments accordingly (IPCC 2012).

To operationalize this learning loop, the following question can be asked: '*Are we doing things right?*' (CCAFS s.a.). The answer to this question improves the efficiency of existing actions and routines.

2.2.3 Double loop learning

Argyris and Schön (1978) labeled double loop learning with the situation when an "error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies and objectives" (Argyris & Schön 1978, p.3). Whereas single loop learning is taking present frameworks for granted, double loop learning involves questioning the role of the framing system which are underlying the actual goals and strategies. While single loop learning is following the routines according to a pre-set plan and affords therefore a greater control, double loop learning is more reflexive and creative and considers the 'goodness' of the goal (Smith 2001, 2003).

Regarding to the discussion earlier on persistence, adaptability and transformability, this double loop learning can be categorized as adaptability. Adaptability is the capacity to learn while developing within the current stability domain (Berkes 2007). Since double loop learning is changing the actions, while remaining in the same stability domain. For example, a community inhabitant wants to increase its income to be better prepared for the extreme droughts, in which he cannot cultivate on his land, it might find another source of income. When this community inhabitants was only going

through single loop learning, it would have persist in his action and only improved its action. This could be the case, for example, when the community inhabitant would try to cultivate his land in the dry period by using more irrigation.

When the people in the community go through double loop learning they do not only search for alternative actions or tools to achieve the same outcome, they also examine the appropriateness of the currently chosen outcomes. This learning therefore involves reflection on norms and values (Argyris et al. 1985). According to Huw & Nutley (2000) double loop learning thereby questions the very nature of the paths and the feedback loops to remain on that path. However, I perceive the latter as triple loop learning as it goes a step further than changing the frames, it questions the context of the frames which is shown in figure 1. Triple loop learning is described later on.

In figure 1 is shown that double loop learning changes the frames in which the actions take place. Double loop learning enables people to learn about the reasoning behind their action, which could enable shifts in behavior and understanding (Armitage et al. 2008). The question in this phase of learning is '*Are we doing right things?'* (CCAFS s.a.), by answer reveals whether goals and strategies are appropriate. Corrective actions are executed after the problem is reframed and different goals are identified (Pelling et al. 2008). When considering the flood management example from IPCC (2012), as is introduced in single loop learning, double loop learning occurs when the goals of the flood management regime are examined to determine if the regime is sustainable and resilient to expected floods over a long time period. The example is regarding the sustainability of the regime, which is confusing as it can be considered as the context of the action, however, in this master thesis I define double loop learning as reframing the action.

2.2.4 Triple loop learning

This ultimate stage in learning has got different names over the past; triple loop learning, meta-learning and deutero learning (Georges et al. 1999; Huw & Nutley 2000; Örtenblad 2004). All three definitions are similar but used in a different way. Triple loop learning is defined as "members discover that how they and their predecessors have facilitated or inhibited learning, and produce new structures and strategies for learning" (Georges et al. 1999, p.2). Similar to triple learning is meta-learning, which is "the ability of organizations to learn about the contexts of their learning when they are able to identify when and how they learn and when and how they do not, and then adapt accordingly" (Huw & Nutley 2000, p.999). Örtenblad states that deutero learning is "becoming aware of how they single- and double-loop learn" (Örtenblad 2004, p.133).

To create a better overview, the term triple loop learning is used in this thesis, which include all the former mentioned definitions of triple loop learning, meta-learning and deutero learning. All these definitions come down to the fact that triple loop learning entails a fundamental change of the mental model where the management process is based on (Keen and Mahanty 2006).

Learning can be categorized into adaptation to the stressor, which entails single- and double loop learning, and transformation, which requires triple loop learning (Sterling 2010). Kysar (2004) claims that triple loop learning is analogue for transformation and that it can lead to recasting institutions, social structures and constructions that contain and moderate risk to accommodate more

fundamental changes in world view (Pelling 2010). This refers to the transformability which is described earlier in this chapter.

In figure 1 an overview is provided of learning which describes triple loop learning as transforming. When someone or a group of people, in this case a community, goes through triple loop learning, it creates a fundamentally new system with new processes (Folke et al. 2010). According to the figure of IPCC (2012) (figure 1) triple loop learning changes the context in which the frames of the actions are set. In the flood control example this might entail entirely new approaches to governance and participatory risk management. These new approaches involves additional parties, crossing institutional, national, cultural and other boundaries that contribute significantly to flood risk. It can also involve planning which is aimed at robust actions instead of strategies considering optimization for particular constituents (Pahl-Wostl 2009).

Triple loop learning differs from double loop learning as double loop learning does not involve the commitment and change of other actions or parties. While double loop learning can be executed by one person, triple loop learning needs the involvement of many. To further illustrate, triple loop learning can be seen as double loop learning about double loop learning. This means that the frames of the action are reframed to which the context of the action and it outcomes changes entirely (see figure 1).

Triple-loop learning triggers changes in governance structures and underlying norms (Armitage et al. 2008). When people are learning from their errors and asking themselves *'How do we decide what is right?'* values and beliefs can alter (CCAFS s.a.).

2.3 General overview

Taking the above written discussion about persistence, adaptability and transformability into account, the definition of Carpenter et al. (2001) is the most useful definition to use in this master thesis and is applied on the community level:

"The amount of disturbance a system can absorb while still remaining within the same state, the extent to which the system is capable of self-organization, and the extent to which the system can build and enhance the capacity for learning to adapt" (Carpenter et al. 2001, pp. 766).

The first part of the definition reflects the persistence of resilience. Absorbing disturbance while remaining in the same state is equal to making adjustments to stay in the same stability domain. The second part, the extent to which the system is capable of self-organization, reflects the coping style, self-efficacy and the sense of community. With these elements a community is able to confront the problem as a community. When the coping style is problem focused the community is not ignoring the problem but dealing with is. With a high self-efficacy among the inhabitants of the community, the community is open for information and is dealing with the consequences of climate change (Bachrach & Zautra 1985; Yates et al. 1999). And the sense of community makes the community work self-organized, in which all the inhabitants are willing to help each other. The third part of the definition, the capacity for learning to adapt, reflects the learning capacity of the inhabitants of a community.

In sum, this master thesis is based on two components of community resilience to climate change: Community resilience and learning. An overview of the operationalization of these two components is provided below:

Community level: Community resilience

- Coping style;
    - Problem-focused coping or emotion-focused coping
        - Problem-focused coping increases the community resilience
- Self-efficacy;
    - High self-efficacy or low self-efficacy
        - High self-efficacy increases community resilience
- Sense of community;
    - Sense of belonging
    - Resource equity
        - High resource equity increases community resilience.

Personal level: Learning elements

- Zero learning;
    - Repetition of the action or routine although the action or routine failed before.
        - Happens when the problem is ignored or the situation is hopeless.
- Single loop learning;
    - Persistence
        - Changing the action
            - Making the action more efficient
                - Example: Adapting the height of the dike with the expected height of the flood.
- Double loop learning;
    - Adaptability
        - Changing the frame of the action
            - Changing, the framing system which are underlying the actual goals and strategies of the action
                - Example: Examine the goals of the flood management regime to determine if the regime is sustainable and resilient to expected floods over a long time period.
- Triple loop learning;
    - Transformability
        - Changing the context of the framework of the action.
            - A fundamental system change with involvement of other parties
                - Example: Entirely new approaches to governance and participatory risk management.

These criteria are used in interviews. The strategy and the content of these interviews are discussed in the next chapter on the methodology. In figure 2 the conceptual theoretical framework is shown in which is clear how the two types of elements, community resilience elements and learning elements, relate to each other. The framework shown in figure 2 is used to execute the project evaluation in

chapter four. The linkages between community resilience and the learning becomes clear when they are applied in this chapter.

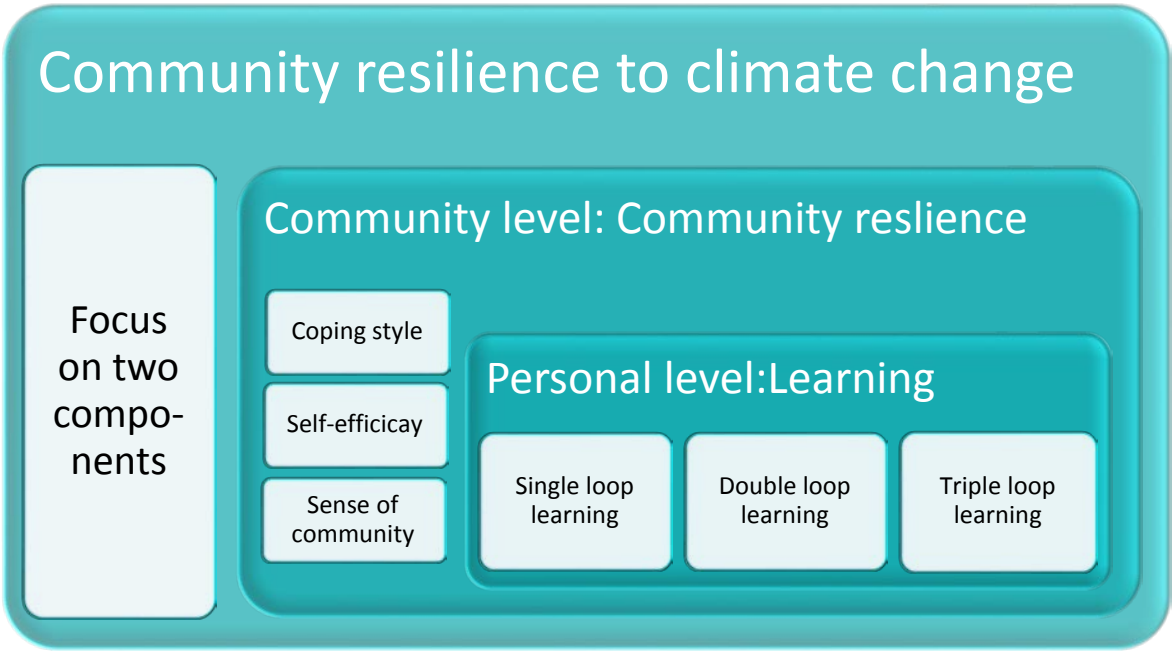

Figure 2: The conceptual theoretical framework of this master thesis on community resilience to climate change, including the influences of the community level and personal level on the community resilience to climate change.

3. Method

In this chapter the methodology of the research is explained. It describes the methods adopted to answer the main research question: *In what manner and to which extent do community-based adaptation projects of NGOs in Bangladesh improve the long-term community resilience to climate change?*

As will be discussed in more detail in this chapter, the primary method is a case study approach. It aims to evaluate in what manner and to which extent a community based climate adaptation project in Bangladesh has improved the resilience of the respective community in the long-term. This case-study approach focuses on a project by the NGO Practical Action held in the community Sreepur in the Gaibandha district. The project ended five years ago and was running between 2004 and 2009, in that way the case study is focused on the long-term effects. This project is compared with a control community called Malbhanga. In addition, steps are taken to generalize the case study findings to a broader set of community-based adaptation projects in Bangladesh.

This chapter starts by outlining the methodology of the case study and its selection. Second, the chosen case study is described. Third, the data collection methods used to conduct the case study are explained: the way of collecting data is explained, including the way of interviewing and the content of the interviews. Fourth, the manners of reflecting on the outcomes of the case study are described. At the end of the chapter the conclusion with an overview of the research structure is provided.

3.1 Case study - Most similar system design

As a key method, this thesis research examines a community-based adaptation project by the NGO Practical Action to delineate its effects for community resilience to climate change. A case study is in fact an intensive analysis of a single unit, where the goal is to understand a larger amount of similar units (Gerring & Seawright 2008). In this research it means to take a closer, and more intense, look at a particular community in the Gaibandha district of Bangladesh and the effect of the project of Practical Action to raise understanding on community-based adaptation projects of Practical Action and other NGOs.

My reason for choosing a case study to answer the research question is to examine the practical outcomes of the project and to gain detailed knowledge on the specific measures implemented in the community that made it evolve into a resilient community.

This case, the project community, will be compared with another case, the control community, to find the differences in community resilience to climate change. These differences reflect the impact of the project on the community resilience. This control community is similar in most of its variables except for the independent variable, which is the implementation of the project from Practical Action five years ago. The long-term effects on the dependent variable, which is the degree of community resilience, will be measured by doing fieldwork.

The general method to perform the fieldwork is to use the Most Similar Systems Design (MSSD), which is displayed in figure 3. This is a design to research systems that are as similar as possible, except for the independent variable to create causality between the dependent and independent

variable. According to Bartolini (1993) this method keeps as many extraneous variables constant as possible. To create as much similarity in the two cases as possible the method uses an intra-nation analysis; the two cases will be in the same country. Therefore, variables as climate, governmental control, culture and so on are close to similar (Heckscher 1962). To enhance the similarities even more the control case is located in the same region as the experimental case.

Figure 3: Methodological overview of independent variable, dependent variable and the intervening variables.

The intervening variables, as illustrated in figure 3, are other variables than the independent variables which can have effect on the dependent variable (Segers 2002). In this case the following variables have to be considered as intervening variables:

- Support from the government (local, national)
- Support from other governmental bodies (national and international)
- Effects of other projects

These intervening variables are considered and continuously examined while selecting the data. In the next section is explained which complications can occur when performing this method.

3.1.1 Selecting the variables

In this research the cases are not selected on the dependent variable but on system variables, such as community size, geographical location, culture etc., to prevent non causation. However, most qualitative studies are using cases that have the same value on the dependent variable, which causes a lack of causality. In this research this would mean that the project community and the control community have the same degree of resilience to climate change. By selecting the two communities on variables such as build and enhanced capacity for learning to adapt, which are improved by de independent variable, there will be no causality between the independent variable and the dependent variable. Also the other way around creates bias; selecting the control community on a lower degree of resilience than the project community. Therefore, by selecting the control community, the idea of selecting on the dependent variable is not included. By only looking at the system variables the outcome of this research is not influenced by selecting on the dependent variable. In this research this means that the control community is not selected on the difference on its degree of resilience. By selecting carefully this research aims to not exclude controversial results, such as a higher degree of resilience in the community with no help of a project of a NGO.

The control community with the most similar system to the case study has many system variables that match. Most of the system variables should be close to matching. While choosing a control community the following variables must be similar to the experimental case:

- Population (size, density, male/female ratio, young/old ratio)

The case study contains 48 households, the control case contains 52 households.

- Culture (religion, traditions)

In both communities the Islam is the dominant religion. In each community there are only few Hindu families, whom live peacefully within the community.

- Climate (temperature, amount of precipitation, climate threats, disaster threats)
- Geographical location (terrain, surrounding mountains or river)

The two communities are located in the same district, so they have the same climate. Both communities are also located near to the river, within a few kilometres.

However, the terrain is different as the control community is located a lower lying area than the project community, this means that the control community is affected by the annual flood while the project community area is high enough to stay dry. As this higher area is an element of the project it is part of the effect of the independent variable and the difference between the altitude of the area is therefore no system variable.

- Income (average income)

While selecting the two communities the income of the inhabitants was not determined yet. This was not feasible to indicate in such a short time, the time which was spent on selecting the communities, and it seemed to be a part of the dependent variable which I did not want to select my communities on.

- Health (estimation of average health situation)

It was not possible to detect this system variable in the time spent selecting the communities. Although in both communities I saw a person with bad health, while spending an afternoon in both communities in order to select them, my healthcare knowledge was not advanced enough to perceive similarities between both communities on this topic. This might not have been so bad as it can be perceived as a part of the dependent variable.

However, to find two systems that are exactly matching is according to Seawright and Gerring (2008) infeasible. The locations differ as the distance to the river are not exactly similar; the project community is 1.5 km away located from the river, while the control community is located 3 km away from the river. The size of population is not exactly the same either. To prevent bias with the small number of cases and to find as similar communities as possible I took three days to select my communities. Considering my time at the field, three weeks, three days seemed reasonable in order to be selective without wasting any valuable time. As three days is limited, not all the differences in system variables could be prevented.

3.1.2 Qualitative versus quantitative method

Whereas the reasoning for the selection of the variables are made clear above, the question remains why this master thesis uses a case study in the first place. The main argument for this is the advantage to focus on a single case which can be intensively examined with qualitative methods even if the resources are relatively limited (Lijphart 1971). However, according to him a case study has also its down sides in not being able to contribute to a generalization or to disprove an established generalization. Due to choosing only one case study and one control case, generalization of the outcomes is not feasible. Kuhn (1987) is pro case studies and claims that a discipline without a large amount of in detail executed case studies is a discipline without systematical production of examples, and that a discipline without examples is an ineffective discipline. Adding on to that, Kuper & Kuper (1985) discovered qualitative research and the advantage of doing case studies prior to the quantitative revolution, pointing out that “more discoveries have arisen from intense observation than from statistics applied to large groups” (Kuper & Kuper 1985, p. 95).

Although case studies have a meaningful value for science since more discoveries arise from intense observations, a generalization of a case study can add an additional value. In order to make a generalization of the outcomes, a reflection of the results is done. This reflection gives a comparative overview of other results from different project and different NGOs. This reflection is provided in chapter 5 and the methodology of this reflection in the section 3.4 of this chapter. Before going into detail on the reflection, the case study is described with its methodology and data collection method.

3.2 Case study description

In this subsection the evaluated project from Practical Action is described. After a general description of the project, which entails information of all the beneficiaries of the project, the project community Sreepur and the control community Malbhanga are introduced. Thereafter, the data collection method which is applied in these two communities is described including its limitations. To provide more insight on how I executed the evaluation the interview structure is provided at the end of this chapter.

The River Erosion Project (REP) took place in Gaibandha, an area where riverbank erosion and annual floods causes permanent loss of land for cultivation and shelter. Due to riverbank erosion people have to flee from their communities, without any of their belongings, to the embankments. In the embankment communities they become the very poor and are situated at the bottom of the social ladder.

During floods people, living in communities which are not yet affected by river erosion, often shelter in places where basic services such as sanitation, water, education and health are low or non-existent. This mostly temporary sheltering leads to a communication deficit and often to an exclusion from mainland infrastructure and services. These people are in need of a more sustainable place to stay and tools to improve their lifestyle and thereby becoming less socially vulnerable. As climate change is making the ice caps of the Himalayas melt in higher quantities it will put more pressure on the water flow through Bangladesh. Helping people in this situation and in the situation in which they end up in after being affected by river erosion, makes them better prepared for the upcoming climate change. Therefore this project goes further than only helping out people in vulnerable situations it helps to make them adapt to climate change, which makes this a community-based adaptation project.

There are many reasons for choosing this location of the project. In the Gaibandha district mortality rates for women and children, who are the most vulnerable in this situation, are significantly higher than in other parts of the country. The vulnerability increases by temporarily migrating husbands, who are working in urban centers. Cultural side-effects such as child labor, early pregnancy and girls marriage are no exception. The complexity of the problems and the remoteness of the district results in a high degree of exploitation, social marginalization and violation of human rights (Gregory 2009).
Practical Action's REP has worked from 2004 until 2009 in 31 unions of the Gaibandha District. The project had a holistic approach to help people that have been affected by river erosion. Practical Action thereby not only focused on climate change and natural disasters but attempted to address the underlying causes of poverty and vulnerability. The main project activities have been centered on infrastructure development:

- Construction of four cluster village
- Three multipurpose shelters
- Seven non formal schools
- Four community dispensaries
- Community based rapid evacuation system.

The four cluster villages were established by providing a new community to the poorest inhabitants of the embankments. These people have been living in the embankments after they had to flee from their original community as river erosion took away their community. The four cluster villages were built on flood free sites and additional trainings were given to the community inhabitants to demonstrate alternative livelihoods. The project community of the case study is one of these four cluster villages. During the trainings skills were taught, knowledge was transferred and awareness about climate change and natural disasters was raised (Gregory 2009).

3.2.1 Project methodology

Five local partners of Practical Action implemented a five year long project, from 2004 until 2009, under the technical field based assistance of Practical Action Bangladesh. In the communities trainings were provided by the local partners, to increase alternative livelihood options. In agriculture the following techniques were trained: Sand bar cropping, floating garden, vegetable cultivation (high value crops) on embankment slops, papaya cultivation on embankment, fruit, medicine and timber plantation, dram stick (sajina plantation), perennial chili production, seed production and preservation.

To create income during flood the inhabitants of the community were trained in fishing, with the following techniques: Cage aquaculture, hapa breeding for fingerling production, improved traditional gear for wild catch during flooding, community based fisheries as a resource for poor households and net making.

To be able to invest in livestock, the community learned how to take care of livestock during the following trainings: Small scale goat/sheep farming, beef fattening, fodder cultivation and storage, poultry/duck farming and bee keeping.

To have multiple income sources and thereby a more sustainable income, the community inhabitants received training on skills for small enterprises, such as: Handicraft training for adolescent girls, tailoring for men and women, community based cold protection through weaving industry development, small trade for household income i.e. spicy production, packaging, improved portray, bamboo and cane.

To enlarge the agricultural skills of the community inhabitant's agro-processing skills were trained, such as: Agro-processing skill development for value addition and hygiene, skill training on disaster food processing and storage, demonstration of improved kitchen.

Another source of income was created by training the inhabitants in light engineering skills such as: Welding training for unemployed youths, electric arc welding and wiring, skill training on repair and maintenance of diesel engine, power tiller repair and maintenance, driving skill training, skill training on Rickshaw van repair and maintenance.

To give more structure to the community and create a sense of belonging community services were trained to a group of inhabitants, elected by the community themselves. These community services involved: Community vaccinator, community based extension system, community volunteer group development.

3.2.1.1 Sreepur

The Sreepur community is the chosen project community of the case study, which was involved in the project described above. Sreepur is one of the four cluster villages which was established by the project. The inhabitants of the cluster village Sreepur were selected from an embankment site where many people were poor due to the effects of river erosion. The eroded river caused these people to flee from the water and leave all their belongings behind. With no capital left they moved to the embankment to settle in houses they had to make themselves. Often these houses were not capable

of surviving even the small storms, and each time they were forced to invest all their money, if they had any, in rebuilding and repairs. In these years the people living in these embankments were doing jobs with no potential of earning more money in the future and no investments were made into cattle since they had neither money nor knowledge on how to save money. Practical Action selected the most vulnerable and dispossessed people from these embankments and offered them a new house in a newly built community. Moreover, the inhabitants of the Sreepur community received training to improve their skills, as are described in the subsection 3.2.1 (Gregory 2009).

This community is located at 1.5 kilometers from the river and has fertile ground in its surrounding; to prevent flooding the community is elevated 3 meters. Since the community is turns into an island during floods, a boat is provided as a mode of transport. The community can be divided in two parts, which are separated during floods, each containing 48 households. The focus of this research is on the part of the community where all community facilities as it could be seen as the central part of the community. This part of the community is the left “island”. In this part of the community a school is built, which provides education for the first two years of elementary school. Also a community center is established to create a sense of belonging amongst the inhabitants and to have ceremonies at. A communal cattle shed is built, to support cattle rearing in the community. In the community there are three places for toilets, with every place containing 4 toilets, 4 places for showers/sanitation and 10 drinking water tube-wells.

3.2.1.2 Malbhanga

The Malbhanga community has not been involved in any project from an NGO, or other kinds of organizations. Therefore this community is suitable to compare with the Sreepur community as it has no or little intervening variables.

Malbhanga has many system variables that match with the system variables of Sreepur, such as; the location which is remote and close to the river side, the isolation during floods as it becomes an island, the size of 53 households (Sreepur has 48 households), the religious background of the inhabitants which is mostly Muslim. However, although this community has existed over 60 years, it has not been affected by river erosion. The fact that this community exists much longer then the Sreepur community could possibly explain some differences found in their livelihoods. However, it also makes it interesting as this control community can be seen as the previous community the Sreepur inhabitants lived in, before they were affected by river erosion.

Although the inhabitants have not been involved in any kind of project, they do get some help from the government as the government installed one good functioning tube-well and provide vaccinations to the children. The latter is a national healthcare service of the government to protect children from diseases. Besides implementing the tube-well and this basic national healthcare service, no aid is given to this community.

The differences between Sreepur and Malbhanga, which are caused do to the project, are analyzed in more detail in the next chapter.

3.3 Data collection method

The following three types of data are collected:

- 23 interviews with inhabitants of two communities in the Gaibandha district of Bangladesh;
- 4 focus group sessions;
- Data from other project evaluations:
    - Short-term evaluation of the River Erosion Project;
    - Other NGOs working on climate resilience in Bangladesh.

To gather the information which is needed to define if a community is resilient to climate change and what the effects of the projects were on the community resilience to climate change, semi-structured interviews and observation are performed. These interviews provide an insight of people's perception of the degree on their community resilience to climate change. The criteria used in the interviews consist of the two key concepts community resilience and learning, which are described in the previous chapter. In these interviews the methodology of *"Participatory Assessment of Development (PADev)"* are used to make a reflection of the perspectives on the outcomes of the project. PADev is a long-term experimental research project to test and develop a new participatory and holistic methodology for assessing development (Belemvire et al. 2013). It investigates the effects of different projects and agencies on the perceived outcomes of the community. By not focusing on methods that measure effects, such as a cost-benefit analysis, but on perception-based outcomes of projects, PADev aims to research the effectiveness of projects. Thereby the effects of a cost-benefit analysis are not included, as people are often badly informed about benefits and costs. PADev organizes a three day-long discussion among the community inhabitants about the effectiveness of all the projects that have been active in the community.

The methodology of PADev, which describes how to obtain reliable information and how to be respectful to the interviewees, is used to prepare the interviews. The first lesson is taken from the method on how to assess the perceived impact of the project on resilience to climate change. The interviewees are asked how they perceive the impact of the project on resilience both "then", which is the situation right after the implementation, and "now", which is five years later. This difference between "then" and "now" distinguishes short-term project outcomes from long-term project outcomes and with this approach implementation errors and lack of long-term effects can be discovered. Although the interviews were well prepared, it was hard for the interpreter to understand in the beginning what I wanted to ask. Therefore, the questions about "then" and "now" took up much of the interview time and were thereby summarized to: '*What was your provision before the project'* and '*What is your provision now'.* After this question the interviewees understood to which "*then"* I was referring and could answer questions about other improvements.

To prevent biased situations the report from Practical Action was used to check if the interviewee remembers the outcomes from five years ago by asking if they were involved in any of the trainings. When they did not remember the project or trainings I asked if they participated in a particular training, such as cattle breeding or sand bar cropping. After this question they often started to remember their training .

The questions regarding the two key concepts community resilience and learning were prepared in advance, with a clear choice in signs between the following options: ++ Big positive impact, + Small

positive impact, / No impact, - Small negative impact, -- Big negative impact (Belemvire et al. 2013). These different answers were written down in these sign, so that the interviewee can point at the answers, in order to make it less complicated, more structured for the interviewee and the interviewer. Although the signs are well known among the educated people in Bangladesh, the community inhabitants did not understand these signs. The cause for this misunderstanding is that many of the community inhabitants cannot read and the inhabitants that were able to read did not know any western signs. During the first interviews this method was used but after a few long during interviews I realized that this approach was not working. When I started to ask if they were happy about it or not and if the improvements were big or little answers came easier. When I doubted their answer, because it was contradicting or the translation was very short while the interviewees answer was very long, I asked for more detail. Thereby I sometimes received answers which were not only good or bad but also somewhere in between good and bad with some interesting facts and perceptions.

In this research the interviewees are asked to connect changes with the project, and thereby which changes on community resilience are caused by the project in a negative or positive way (Belemvire et al. 2013). This is included in the same interviews and functions as a check for the causality of the project with the changes in resilience. Examples for this are the effects of the project on the willingness to help others in need, which is a result of community resilience.

PADev worked with different groups of inhabitants to create room for every type of inhabitant to speak up and to prevent a one-sided story. The following types of inhabitants were dived in groups: men/women, young/old, educated/non-educated. To obtain different views and to create a holistic overview of the effect of the project on community resilience to climate change, an interview is taken from at least one inhabitant from each category of inhabitants (Belemvire et al. 2013). As time was limited a thorough search for all these different categories was not feasible. Moreover, many of the inhabitants were working during the time I was doing interviews in the communities. Therefore, the selection took place right before the interview. By looking at my previous interviews I decided who I wanted; a young women, an old man, a rich person or a poor person. In the end I did manage to at least interview one person from each category.

Taking into account the experiences of PADev it is essential to carefully invite different kind of inhabitants. The richest inhabitants will have less time and often have less interest in participating in an interview. They often walk away and are disturbed with their business. The poorest inhabitants should be invited in a separate meeting without other inhabitants since they often have the feeling of being an outsider. The relatively poor and relatively rich inhabitants are often not very difficult to reach. However, in this research they will be separated as the relatively poor could feel dominated by the relatively rich inhabitants. To follow these guidelines from PADev doing individual interviews seemed to be the most practical solution. Two limitations of this plan were not foreseen at forehand; the heat during the interviews and the sensation of me being in their community. Both resulted in the same outcome being a low level of privacy during the interviews. Due to the heat we were not able to sit inside the houses as no wind was available inside to cool the interview setting. As it was already 40 degrees outside, indoor interviews were no option. Since I am not used to the heat the only option was to sit outside underneath a tree, where other people and animals were already sitting because they wanted to avoid the heat too. Moreover, due to their curiosity I was always

surrounded by community inhabitants. During the first interviews I was striving to get as much privacy as possible, however, after endless discussions about the need for privacy between my interpreter and the community inhabitants I lost the willpower to try. The only thing I did need was the silence from bystanders as I wanted to record my interview. Even this was not easy to achieve, as the cattle cannot be asked to be silent and is therefore clearly present on my recordings.

Another aspect of asking inhabitants for a contribution to this research by doing an interview is the reward. PADev made sure not to mention any reward, so no one expected a reward. However, after the workshops everybody got a small reward in payment. Since this research is not organized by an organization, no reward is given. To create a sense of togetherness and being on the same level, PADev suggests to share food together. By doing this the interviewee feels appreciated and sees that you are sharing your food, which makes the interviewee feel more equal to the interviewer (Belemvire et al. 2013). Although it was my intention to share food every day, the local staff and my interpreter strongly discouraged me to do that. They argued that when bringing food to the community everyone would want some food from me and I will always be short on food as more bystanders will come when you bring food.

The interviews in both communities are based on perceptions of the inhabitants. Therefore, practical implementation, such as water infrastructure in the communities and interviews with authorities will function as a check for the results of the interviews in the communities. The perception of community inhabitants can be biased by their attitude towards the project or other kinds of biases such as political view, participation in the project, personal benefit or disadvantage by the project and so on. During the interviews it is important to keep in mind that these personal factors can play a role and might cause a bias. However, there is also a possibility that Practical Action overlooked some elements of the projects outcome. Therefore, it is important to consider biases at both levels; the community level and the organizational level. This is executed by reflecting my results with the results of the organization, which was a validation of the results. The Head of Policy Practice and Program Development of Practical Action Bangladesh, Faruk Ul-Islam, helped me by overseeing my first results and no comments were made on missed out elements of the project. However, he did direct me to look into more detail on elements such as housing and medical care. This, and other missing information, convinced me to go back to the communities once more and to execute focus group sessions in both communities.

In order to check the community inhabitant's perceptions the practical measures consist of observation on project implementations and checking the project outcome report from Practical Action itself, which was established right after the project. This was very useful as contradictions between the interviews and observations did occur.

3.3.1 Interview structure

The interview structures are based on the above described data collection method. There are two different interviews; one for the project community and one for the control community. The interview for the control community consists of five parts: Personal information, project memory, the project's general impact, the project's impact on community resilience and other impacts. The first part is used to identify the type of inhabitant (male/female, rich/poor, educated/uneducated). Moreover, this part can also retrieve information about the community resilience, as the income

level among the community inhabitants reflects the resource equity, which is a part of the sense of community. The second part functions as a check if the interviewee knows about which project I am asking questions. The third part is about the general impact of the project which is retrieved by asking what their situation was before the project and after the project. The fourth part is about the impact of the project on community resilience, which is divided into the two key concepts community resilience and learning. The fifth part functions as detector of intervening variables, which are interventions of other NGOs or governmental organizations that helped them in becoming more resilient.

- Personal information
    - Age
    - Community function
    - Family function
    - Income (resource equity)
    - Family size
    - Location of the house in the community
- Project memory
    - What do you remember from the project?
    - In which training were you involved?
- General impact of the project
    - What are the effects of the project on:
        - Health
        - Infrastructure
        - Housing
        - Income
        - Social connections
    - What did your life look like before the project?
        - And before you fled to the embankments?
    - What does your life look like right now?
- The impact of the project on the community resilience to climate change
    - Community resilience elements
        - From what kind of climate change problems do you suffer?
        - How are you coping with this problem?
        - Are people in your community helping you?
    - Learning elements
        - Short-term results: What changed right after the project?
            - How did you change your action/routine?
                - Changing the action: Did you change your action?
                    - Presence of single loop learning
                - Changing the frame of the action: Did you replace your action by another action? Or do you now have a different outcome which is better for you?
                    - Presence of double loop learning
                - Did the community change in its system to make this change in your action?

                - Presence of triple loop learning
        - Long-term results: What changed between the end of the project and now?
            - How did you change your action/routine?
                - Changing the action: Did you change your action?
                    - Presence of single loop learning
                - Changing the frame of the action: Did you replace your action by another action? Or do you now have a different outcome which is better for you?
                    - Presence of double loop learning
                - Did the community change in its system to make this change in your action?
                    - Presence of triple loop learning
- Other elements besides the project that increased the community resilience
    - Other NGOs which helped the interviewee
        - With getting more resilient by:
            - Improving health
            - Improving skills
            - Providing microcredit
    - Governmental interventions which helped the interviewee
        - With getting more resilient by:
            - Improving health
            - Improving skills

The interview for the control community is shorter as it does not contain the project memory. The first part, the personal information, consists of the same elements as the interview of the project community. Again, this part contributes to gaining knowledge on the resource equity information. The second part is about the degree of community resilience and the third part about the degree of learning. The fourth part is the same about other interventions that might helped the interviewee and the community to become more resilient to climate change.

- Personal information
    - Age
    - Community function
    - Family function
    - Income (resource equity)
    - Family size
    - Location of the house in the community
- Community resilience elements
        - From what kind of climate change problems do you suffer?
        - How are you coping with this problem?
        - Are people in your community helping you?
- Learning elements
    - What did you change to cope with climate change in a better way?
        - Changing the action: Did you change your action?
            - Presence of single loop learning

        - Changing the frame of the action: Did you replace your action by another action? Or do you now have a different outcome which is better for you?
            - Presence of double loop learning
        - Did the community change in its system to make this change in your action?
            - Presence of triple loop learning
- Elements that increased the community resilience
    - NGOs which helped the interviewee
        - With getting more resilient by:
            - Improving health
            - Improving skills
            - Providing microcredit
    - Governmental interventions which helped the interviewee
        - With getting more resilient by:
            - Improving health
            - Improving skills

3.4 Reflection method

As is explained in the beginning of this chapter a reflection of the outcomes of the project evaluation will functions as a validation of the results and as a generalization of the findings of the case study. The first part is a comparison with the short-term outcomes of the project. The short-term outcomes were evaluated by an individual evaluator and by Practical Action itself. The aim of this part is in twofold, the first one is to validate my findings and the second is to detect changes over time. It could be that some skills are not performed anymore or that an implemented facility was first successful but was not functioning after five years. Or it could be that the community learned more over time and have an increased community resilience after five years. This information is interesting as it could show possible implementation gap to Practical Action and other NGOs. The two evaluations which are used are compared on the two key factors of community resilience to climate change: Community resilience and learning. Therefore, not all the topics of the short-term evaluation are analyzed, only the parts relevant for this thesis research.

The second part is a comparison with other projects of other NGOs; the effects of other projects on community resilience are compared with the findings of the case study. Relevant projects consist of projects with similar goals, with similar problems and similar regions, which are vulnerable to floods and river erosion. These projects are focusing on climate change and the adaptation on community level. To provide an overview of comparable projects and to be able to generalize the findings of the case study five other projects are compared with this project. The comparison is based on the key findings of community resilience to climate change, which are evaluated in the next chapter: The project evaluation.

Since other NGOs have only few projects on climate change and the projects which they have are only short-term-evaluated in the annual reports the information on the outcomes of these projects is scarce. This could be because of the lack of transparency; NGOs want to keep their evaluations for themselves, or it could be that long-term project evaluations are not regularly used by NGOs. Therefore the long-term evaluation of the *Disappearing Lands* projects is compared with short-term

evaluations of other projects. Which effects this has on the comparison is mentioned in the comparison itself and in the discussion section of the conclusion of this master thesis.

3.5 Conclusion

To sum up the methodology of this research figure 4 shows an overview of the planned methodology. In the inner circle the case study is shown, with its findings from the interviews and the observations as control factor. Secondly, the controlling circle from Practical Action, which includes the project short-term outcome report and the reflection with Practical Action to check the findings of the case study. And thirdly, the outer circle, the generalization, which is a comparison between the case study findings and other project evaluation findings from other NGOs.

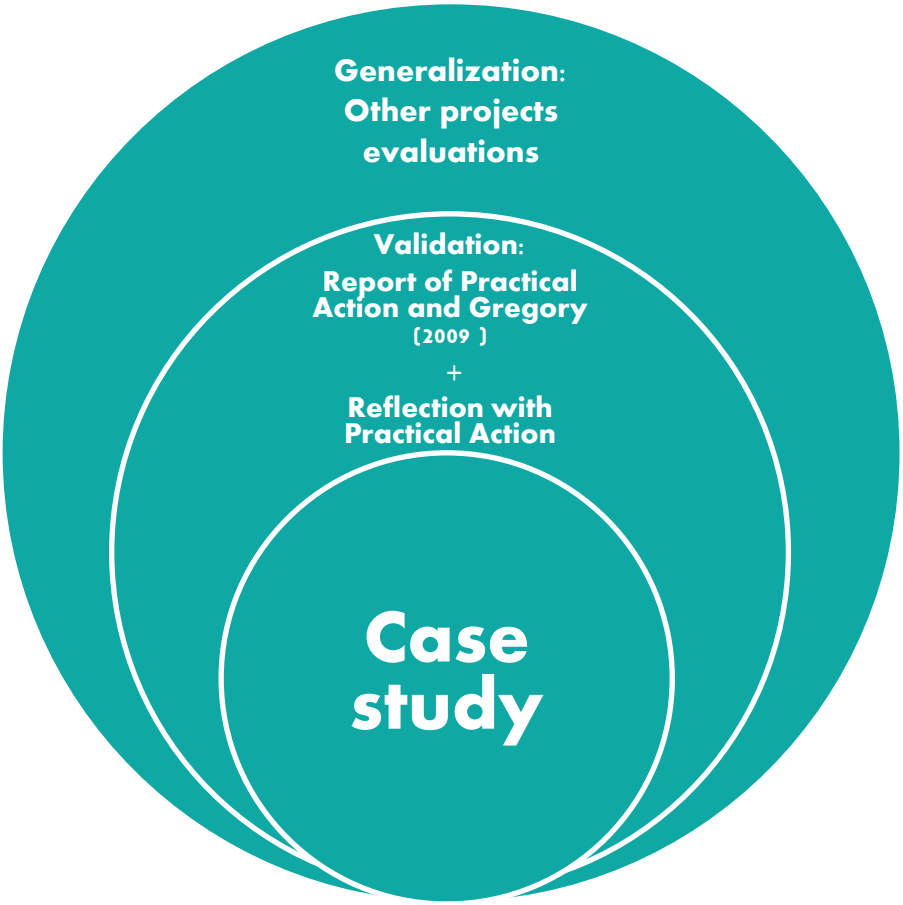

Figure 4: Methodological overview of this master thesis.

4. Resilience to climate change in Sreepur

The project *Disappearing Lands* from Practical Action, described in the previous methodology chapter is evaluated on its effect on community resilience to climate change by using the elements of community resilience and learning, which is elaborated on in the theoretical framework section. As the project ended in 2009 the learning loops from 2009 on are used to clarify to which extent there is more community resilience in the project community Sreepur than in the control community Malbhanga.

The evaluation shows that the increased income of the community inhabitants is central in the two components community resilience and in learning. Therefore, the income sources and structures are evaluated first. Second, an evaluation is made of the project's effect on the community resilience. Third, each learning loop is separately evaluated with comparisons between the two communities, including zero learning, single loop learning, double loop learning and triple loop learning. At the end of this chapter a conclusion is made on the effect of the project on the community resilience to climate change. The results of this chapter are used in the next chapter, the reflection of the results, which compares the results with other project evaluations. In this project evaluation references are made to the interviews, observations and to the focus group sessions in the project community and the control community. The outlines of the interviews can be found in the Annex and the information of the observations and focus group sessions can be provided on request.

Before evaluating the effect of the independent variable, which is the project *Disappearing Lands*, on the dependent variable, which is the community resilience to climate change, the intervening variables are evaluated here. The intervening variables are the other impacts on community resilience, this could be other projects or governmental interventions. Since the quality of the community's housing and facilities is much higher than surrounding communities, NGOs do not consider the Sreepur community as a community in needs for more help. The Sreepur inhabitants realize this and do agree that others need more help than they. The government offers the Sreepur inhabitants the same options as the Malbhanga inhabitants; basic healthcare and free elementary schooling. Concrete interventions in the Sreepur community did not occur between the project implementation and now. However, the tube-wells are checked on arsenic water pollution, which indicates that the government or any scientific NGO has been visiting the Sreepur community. According to Practical Action and the Sreepur community the tube-wells are only checked and no action has been taken on to solve the arsenic water pollution. Therefore it can be assumed that there is no variable which could have been intervening the independent and the dependent variable.

4.1 Income: A source of many differences

The raised income is an improvement of the livelihoods of the inhabitants of Sreepur which they are all very aware of. The way how the inhabitants of Sreepur increased their income is something which is often discussed in the interviews. Most of them start by mentioning they learned skills from the project to improve their income, often improved agricultural skills or small enterprise skills. This is followed by changes they made in their skills or lifestyle to make it more efficient and effective. The latter is a type of learning, which is discussed in the evaluation of the learning loops (subsection 4.3.1, 4.3.2, 4.3.3, 4.3.4).

Having more income is not directly learned by the community inhabitants. However, it influences many aspects of their lives which they are able to improve and thereby they are learning. The community inhabitants learn how to deal with climate change in an indirect way through improving their income. With this improved income they are less vulnerable to climate change.

The increased income influenced the community resilience to climate change of the Sreepur inhabitants in multiple ways. The project taught them how to save money and this saved money is making them less vulnerable to climate change. For example, when flood comes most inhabitants of Sreepur have enough saved money to carry on their lives like they used to. This is a tremendous difference with their lives in their previous communities. In their previous communities, the ones they lived in before they had to flee away from river erosion to the embankments, the families were mostly depended on only one source of income and they mostly had no income during flood. In times of flood the families suffered from having no sufficient enough food to feed their family (Annex 1).

This lack of security in their income forced families to part temporarily. The husbands temporary migrated to Dhaka or Chittagong to work as a rickshaw puller or brickfield worker to earn more money for their family (Annex 1). While leaving his wife and children alone made the family more vulnerable to starvation as the culture in Bangladesh states that the man in the care-taker of the family and the wife has to follow his lead. Without any leader, women with children are more vulnerable to social exclusion and thereby more vulnerable for any other factor in their lives (Schuler et al. 1998), such as climate change. Although, the project created more secure income for the community inhabitants of Sreepur, and thereby reduced the amount of temporary migrated men, it still is used by the relatively poor families. The difference between the families that have to part and families that do not have to part could decrease the community spirit, as it could be seen as an inequality. However, the whole community has increased their average income and there are less migration days which mean that the system of earning money is shifting to another structure.

Besides the temporary migration of the men some families also temporary migrate as a family. Some houses in the community were not occupied at the moment I was doing visiting the community of Sreepur. The reason for the temporary migration of the whole family remained unclear, however, neighbors told me that the men of the migrated family had a job in Dhaka or Chittagong (Focus group). Although the families received a house from the project and training to increase their income, they decided to leave the community temporary. The temporary migration of men and of whole families is discussed in the section 4.3.1.

Other influences of the increased income are health related; less labor intensive work is done by the relative rich inhabitants of Sreepur. For example, many of them own land which they cultivate by hiring agricultural day labors which results in less physical problems and thereby a better health for the community inhabitants that own the land. However, the burden of the intensive work is transferred to others which in their turn have a higher chance of health related problems. Although some of these landowners in Sreepur did such labor intensive work, they now seem to have no problem with letting others do this labor intensive work which could indicate immoral behavior. However, they mentioned that they try to be a good landowner, who provides its workers with a decent salary. They feel content with their actions as they are providing work for the relative poor

(Annex 1; Interview 1). With this in mind the indication of their behavior being immoral can therefore be refuted.

Another interesting observation is that the increased income made the inhabitants more confident and increased their network and social connections. For example, the last day the community leader decided to go for lunch with us, and although I could not understand their language, it felt like the community leader and the project staff was equals. The community leader had enough money to buy his own lunch and when I had some questions to him it felt very informal, just like with the other Banglashi's. Not only the community leader but also the other community inhabitants of Sreepur mentioned that they help out other communities with their problems. Their increased confidence and their increased networks and social connections are related to the sense of community, which is part of the community resilience elements. As the community inhabitants have more social connections they are spreading the word of their community being a community, which increases the sense of community. In this way the increased income enhances a community resilience element; sense of community.

While the Sreepur community has a higher average income, most of the people in Malbhanga have, agricultural or non-agricultural day labor jobs and many are still migrating to urban areas for work. However, there are also people with small enterprises, for example somebody sells chickens house-to-house. But during flood this is hampered as the range of selling chickens is not big because of lack of, or too expensive, transportation. That is why during flood he has no or little income. This difference shows that Malbhanga is more vulnerable for climate change then Sreepur considering their income. The results from table 1 reflect the impact of the project on the income level of the community inhabitants. On average inhabitants of the community Sreepur have a higher income, more cattle, a higher contribution to ceremonies and a lower loan.

Table 1: Income assessment of Malbhanga and Sreepur, based on 10 interviews in each community (Annex 1, Annex 2).

	Malbhanga	Sreepur
Average income	177 taka per day	305 taka per day
Average amount of cattle		
Cows	0,3	1,6
Goats	0,2	1,2
Sheep	0	0,5
Chicken	0,2	4,7
Ducks	0	2,1
Total	0,7	14,3 (including small cattle)
Average contribution to ceremonies	270 taka	530 taka
Average loans at the moment	12.600 taka	3.200 taka

4.2 Community resilience

In the theoretical framework is shown that there are two components of community resilience to climate change: community resilience and learning. Learning is thereby a part of the community resilience concept, which is explained in chapter 2. In this section the more general community resilience is evaluated, with no further elaboration on learning. The components are: coping style, self-efficacy and sense of community. The coping style of the inhabitants can be problem-focused or emotion-focused, with problem focused increasing the community resilience. The self-efficacy of the community inhabitants can be high or low, with a high self-efficacy increasing the community resilience. And the sense of community which can be high or low, with a high sense of community increasing the community resilience. A sense of community can be increased for example through community buildings, which reflects a sense of belonging. And a sense of community can be increased for example through high resource equity among the community inhabitants. This resource equity does also involve the access to facilities.

4.2.1 Coping style

In the interviews there were no direct questions regarding the coping style. However, indirectly the inhabitants of Sreepur are having a more problem-focused coping style than the inhabitants of Malbhanga. The reason for this is the higher income, which is discussed in the previous subsection. Thanks to this higher income the inhabitants of Sreepur having less stress when they harvest fails or when they have less work. This relatively lesser stress creates a situation in which the inhabitants can focus on the problem instead of panicking about their situation.

This is different from the situation in Malbhanga, when an activity fails in the Malbhanga community inhabitants have no saved money to fall back on. This creates stress, which takes away the space to think about the problem. Therefore, the inhabitants of Malbhanga have an emotion-focused coping style. This also has something to do with their resource dependency. Since the inhabitants of Malbhanga are mostly depending on one income source, mostly agriculture, resource depletion can occur when climate change causes more droughts or a sudden flood.

4.2.2 Self-efficacy

In the interviews were also no direct questions about the self-efficacy of the inhabitants, simply because these questions were too complicated to understand. However, the self-efficacy has a strong connection with zero learning. When someone has a low self-efficacy they tend to feel hopeless, as they do not feel able to solve the problem. This situation occurs when someone goes through zero learning. A person with a high self-efficacy goes through learning,

To which extent the Sreepur community and its inhabitants have a higher self-efficacy than the Malbhanga community and its inhabitants can be defined by section 4.3 about learning.

4.2.3 Sense of community

The sense of community has been influenced by the project in three ways; through building community locations, through creating resource equity and through creating access to facilities. These three factors are discussed in subsections below and are retrieved from the interviews and focus groups, by gathering general information about the community and the facilities.

4.2.3.1 Sense of community through community buildings

By building community locations there is a greater sense of belonging as the inhabitants have something which is particular made for the community and can solely be used by community inhabitants (Focus group). This sense of belonging increases the sense of community which in its turn increases the community resilience. This sense of community is particularly important when considering climate change, since people are more willing to help each other in times of need when the sense of community is high.

The project built three locations to enhance the sense of community: the community shed, the community school and the community center. The community shed enabled and encouraged inhabitants from the start of the project to protect their cattle from drought and intensive rainfall. Since the cattle in the Sreepur community always has a place of shadow or protection from storms, the cattle in the Sreepur community has become more resilient to climate change. The community shed is also part resource equity.

When comparing with the Malbhanga community, the inhabitants have no common shed with a roof. In the Malbhanga community people do share places where they keep their cattle but these places are outside, which means that the cows are tied up to a fence with in front of them some straw in the heat of the sun. Some people in the Malbhanga community create more shadow for their cattle and some have inside places for the cattle but most of these places are not well ventilated (Observations).

The second location which proves to increase the community resilience of the Sreepur community is their community school. This is a pre-primary school for the youngest children built in the community village. As a result, the youngest children do not have to walk long distances to their school, which encourages the parents to let their children go to school. This does not only increases the amount of children going to school but also empowers both parents to create an income during the time the children go to school. The inhabitants of the Sreepur community are more encouraged to give their children a high school education (Focus group). And since the children are learning constantly while going to school, their learning skills are improved. Going to high school even further improves these learning skills. These learning skills will make the children more resilient.

In the Malbhanga community all the children go to primary school as well, but the amount of children that finish high school is lower (Focus group). Therefore, it can be stated that finishing high school does not only have to do with the fact that the children are going to school from an early age on, it also has to do with the fact whether the children need to contribute to the income of the family. In poorer families children often need to contribute to the family income at the age when going to high school.

Since the family income of the inhabitants in Sreepur is not depending on the children that should go to high school, the resilience to climate change is higher in Sreepur. In the Malbhanga community this creates a vicious circle in which the children that do not finish high school end up being lower educated and having lower paid jobs and when the time comes they have children, their children need to help out with creating income as well and thereby miss out on the opportunity to get educated.

The third location is the community center which is established for ceremonies, mental refreshments and other community meetings. Although the building reminds the inhabitants of the Sreepur community of being a community, the activities in the community building are not so frequent (Focus group). Furthermore, it is nowadays also used as extra storage space for straw. The community center contributes therefore not as much to the sense of community as has been planned by the project. In the Malbhanga community there is no community center, however, they have a community mosque which is currently under reconstruction (Observations). This mosque reflects their sense of community, as the men have a communal place to pray.

Which of the three buildings would increase a stronger sense of community remains unclear as the two communities have different background and therefore different intervening criteria which can be reasons for their sense of a community. For example, the Malbhanga community exists over 60 years while the Sreepur community has not reached their 10th anniversary. Besides that, the Sreepur community received training and thereby a more structured community which increases the sense of a community; volunteer training, leadership training and elections for the community leader and the volunteer committee (Focus group).

4.2.3.2 Sense of community through resource equity

The housing which the Sreepur community received is creating high resource equity among the community inhabitants. Thanks to their new houses made of brick walls and tin roofs, the inhabitants are protected from the storm (Annex 1). As the Sreepur community is established on an elevated ground the houses do not have to protect them from the floods. And thanks to the strong foundation of their houses they do not have to repair their house after storms, therefore their housing has a higher capacity to protect the community from storms (Observations). Resource equity is according to Norris et al. (2008) a key element in community resilience: communities with the highest resource equity are the most resilient. Regarding climate change the resource equity is of high importance, as it creates a higher willingness to help each other in times of need. The willingness increases since people have more resources and are more able to help others. When extreme weather takes place inhabitants in Sreepur help out people in trouble as they could have been in the same situation.

In the Malbhanga community the type of house, and thereby the resilience to floods, is highly depended on their income. Most of the inhabitants have to repair their houses every year which is very costly (Annex 2). When their house is made of tin, fewer repairs have to be done in comparison with the houses made of straw and jute sticks. The Malbhanga community learned that in the long run the houses made of tin are less expensive and therefore they try to save money. In some cases the inhabitants of Malbhanga borrow money, to build a house made of tin (Annex 2). However, with a tin made house repairs still have to be done on a yearly basis. When water enters the houses wooden or bamboo made foundations start to rot and repairs are needed. These repairs are often replacing parts of the foundation which weakens the stability of the house. The repairs are mostly done by the inhabitants' selves and in figure 5 are shown how improper these repairs are.

When comparing the Malbhanga community with the Sreepur community, the Sreepur community has stronger houses, which offers better protections for storms, and is more resilient thanks to the increased resource equity by having the a house with sufficient quality for each inhabitant.

Figure 5: Provisionally repairs of wooden or bamboo made foundation in houses of the community Malbhanga.

As is described earlier, income is a great improvement in the lives of the inhabitants of Sreepur. However, besides improving their individual lives, it also influences their resource equity. When all the inhabitants have a good income, they have a higher resource equity which creates a community with a higher willingness to help each other (Norris et al. 2008). The inhabitants of Sreepur also have a lower resource dependency, as they often have multiple income sources.

It is already described that Malbhanga has a lower average income and thereby a lower resource equity. They also have a higher resource dependency than the inhabitants of Sreepur.

4.2.3.3 Sense of community through creating facilities

Next to housing other facilities such as tube-wells and toilets are installed by the project. This creates equality amongst the inhabitants of Sreepur, whereby every inhabitant has access to the same facilities. This is another aspect which makes the inhabitants having higher resource equity and therefore more willing to help each other in times of need. As described in the previous subsection, this willingness to help each other is beneficial when climate change is causing more severe weather events and extreme droughts and floods.

The tube-wells in the Sreepur community create an equal access to water, which enhances the community resilience. However, 50% of the tube-wells are polluted with arsenic water, which is a dangerous pollutant that can cause cancer when someone drinks it in the long term (Focus group). The pollutant exists in the higher levels of the ground, the deeper tube-wells have therefore less chance of arsenic pollution. The inhabitants of Sreepur know which tube-wells contain this pollutant, as scientists tested the water of their tube-wells, and are therefore not using these tube-wells anymore (Focus group).

In the Malbhanga community almost everyone has its own tube-well and the people who do not own a tube-well are welcome to use the ones from their neighbors. This shows that also in the Malbhanga community privacy has a high value. However, these tube-wells are, except for two, all polluted with arsenic water. Although the community knows about the presence of this pollutant in almost each tube-well, they are ignoring the health impacts and are still using these tube-wells (Focus group).

The toilets in the Sreepur community provide privacy, as people can close the door of the toilet, and have a storage place for the stool, which creates a better hygiene. Although the toilets are experienced as positive by the inhabitants of the Sreepur community, the observation shows a contradiction. The inhabitants of the Sreepur community often have their own private toilet. These toilets have less quality and are lower in hygiene (Observations). This implies that privacy, in the form of ownership, has a higher value then good hygiene for the Sreepur inhabitants. In figure 6 the difference between the two types of toilets is shown. This lowers the resource equity of the relatively poor inhabitants since some people have a highly wanted private toilet and others still using the community toilets. Although these lower resource equity of the relatively poor causes a lower willingness to help each other in theory, in practice it does not matter what kind of toilet you have during climate change, private or public. The availability of the resources during climate change is of a higher importance.

Figure 6: The toilet left is a public toilet in Sreepur, installed by Practical Action. The toilet on the right side is the private toilet, which inhabitants of Sreepur prefer.

The availability of toilets in the Malbhanga community is highly depending on the income of the family; from the Malbhanga community only 50% of the families have a 'hanging toilet'. These 'hanging toilets' have little privacy and the drain ends into the open field a few meters away. However, this 'hanging toilet' is the best option in the Malbhanga community. The poorer people in the Malbhanga community need to share a toilet with even less privacy and with no working drain. The differences between these toilets are little and are shown in figure 7. The 'hanging toilet' is similar to the private toilet which is used in the Sreepur community. More worse are the poorest people who have to use the open field as a toilet (Focus group). Having a toilet or not has little to do with being more resilient to climate change. However, it can create more health or security problems which can influence the capability of the family to recover from a storm or to survive floods and droughts.

Figure 7: Left the 'hanging toilet' in Malbhanga, right the shared toilet without drainage in Malbhanga.

In short, while in theory these tube-wells and toilets in the Sreepur community offer the inhabitants resource equity, other lower quality toilets are used due to privacy issues. These lower quality toilets are also used by the Malbhanga community but are only affordable for the rich inhabitants. While the relatively poor inhabitants in the Sreepur community have the option to use a hygienic toilet from the project, the relatively poor inhabitants of Malbhanga are forced to go to the open field. This difference indicates that the inhabitants of Sreepur live under healthier circumstances then the inhabitants of Malbhanga. However, the willingness to help each other is similar since in both communities there are differences in what kind of facility someone can afford. This willingness to help each other should be low in both communities according to the unequal resource equity of facilities, however, the local staff of Practical Action explained me that in Bangladesh the norm is to help each other. The latter could be more influential on the community resilience than the accessibility of facilities, but due to another research focus this influence will not be further evaluated.

4.3 Learning

The learning capabilities of the inhabitants of Sreepur are analyzed in this section. The inhabitants of Sreepur undergo different learning loops with different actions, which entails that they have different degrees of self-efficacy. The extent to which the inhabitant learns to deal with climate change reflects on this degree of self-efficacy, starting with having no self-efficacy: zero learning.

4.3.1 Zero learning

Not always do people learn from their mistakes, even though the problems are life threatening. This also goes for the inhabitants of Sreepur. When asking about their actions to solve their problem, the reaction was short and not thought through, it seemed like they accepted the problem and they had no clue where to begin to solve the problem. Some interviewees explained the hopelessness of their situation and did not feel able to change it, in this case their self-efficacy is very low. Other interviewees laughed off their problems and said they are gambling by executing their actions the same way and hoping that this time the outcome will not be disappointing. The latter has partly to do with the degree of self-efficacy and partly to do with ignorance.

4.3.1.1 Rice production becoming less profitable

The latter especially occurred when discussing their rice production. In both communities two types of rice are produced; irriboro rice and amon rice. Irriboro rice can grow in the season after the monsoon and amon rice can grow in the three months just before the monsoon. The latter is

becoming more risky to produce as last year's production failed due to an early starting monsoon. This early monsoon is caused by climate change which makes the snow-caps of the Himalayas melt early and in bigger quantities. These bigger quantities causing extra volumes of water to flow through the Ganges and the Bramaputra rivers, which surprises the society as it happens earlier then the predicted monsoon (IRIN 2008).

All the interviewees who were using amon rice have not harvested it last year, therefore the investment in this year's amon rice is a gamble for them (Annex 1, Annex 2: Interview 2, 3, 8). Some of the interviewees told that they started using irriboro rice a few years ago to have more income and to have at least some rice for their family to eat. However, irriboro rice is produced in another season and does therefore not solve the problem of lost investment of amon rice.

Remarkable is the fact that this gambling is happening in both communities. And even though the Sreepur community can easier cope with the lost investment, thanks to a higher income, it is starting to be less profitable for them to include amon rice in their production. The lost profit is recognized by the Sreepur inhabitants but no actions are taken to change this situation, therefore no learning takes place on this practice.

4.3.1.2 Temporary migration stays a popular coping mechanism

Another problem which is not solved and which most of the inhabitants did not learn from is the temporary migration of the men in both communities. While a man leaves his family to earn money in an urban area the wife and his children are more vulnerable as the culture of Bangladesh sets the standard of a leading husband and a following wife. Especially among the poor this division in roles is visible in the way they interact and which status the husband obtains by being the financial care taker of the family. As described earlier in this chapter, the norm of the society in Bangladesh is that people help each other when necessary. However, the vulnerability of the women is still present since they are not allowed to make any financial decisions (Schuler et al. 1998).

Although the women in Sreepur are empowered by the project to create income as well, the men often still choose to temporary leave their family to create income (Annex 1: Interview 3, 12). As the average days of migration are lowered from 54 to 40 days a year many interviewees seem to have temporary migration still in their income system. The fact that the women are empowered to contribute to the family income could also mean that the relation between husband and wife has slightly changed and that the wife is therefore less vulnerable. However, differences between the two communities considering husband and wife relationships could not be well enough analyzed to confirm the latter statement, due to the sensitivity of the topic and the language barrier.

Until now the temporary migration days decreased in the Sreepur community as they received training to make agricultural work more profitable and a secure income source. However, when climate change continues the temporary migration days of the men might increase due to climate change, when agricultural labor becomes less profitable and the income becomes thereby less secure. Thanks to the tools of the project the inhabitants of Sreepur can learn to deal with climate change by having a higher self-efficacy.

Some families also migrate together to the urban areas, where they live in slums (Focus group). Many families disagree with the idea that these slums are less comfortable to live in, which is the common Western perception. This disagreement involves a different prioritization of needs, as a clean house with facilities is as important to income in western cultures, the income is much more important than the living conditions among relatively poor Bangladeshi people. Even in the Sreepur community, where they have good facilities and housing and an increased chance of a higher income, people have left with their whole family to an urban area to have a more secure income. As mentioned before, the families need to learn how to deal with climate change to prevent further urbanization. When compared to the Malbhanga community, where almost all the families have men that temporary migrate to earn money, there is a little difference as more men choose to leave their family for work (Annex 2).

The temporary migration of the men could be a master thesis on itself as it needs more knowledge on the women empowerment. However, the fact is that still many men choose to temporary migrate to urban areas because they perceive urban areas as places with a higher employment. And although the days of migration have on average slightly decreased, it still is a popular coping mechanism. I perceive this as a loss for the community as they leave their woman more vulnerable, however, it might also be that the sense of community is so high that the men trust the community to take care of their women and children during extreme weather. One thing is certain, the men and women miss each other, and only therefore the temporary migration should shop in my opinion.

4.3.1.3 Degrading housing quality

While the Sreepur community received housing from the project which provides sufficient enough protection from storms, the quality of the windows and doors seem to degrade. Due to heavy storms and intensive use of doors and windows, gaps begin to show in the bamboo material which is used. The interviewees complain about this situation as they have no skills to repair the windows and doors with high quality. In other words, they are not improving themselves to be able to make their windows and doors better protected against the storm, on the contrary their repairs are reducing the quality of the whole house. Figure 8 shows a repaired window which does not offer the same degree of privacy or wind protection as the original window. However, the window can still be closed and with no animals or humans getting in the house, the owner of the house is satisfied with the result. This shows that they have some self-efficacy to repair their houses with satisfying results, however, the self-efficacy is not high enough to make the repairs while remaining the quality of the house.

Figure 8: Repaired window in the Sreepur community.

While the inhabitants of Sreepur make insufficient repairs the inhabitants of Malbhanga have to repair much more and they also have to repair their housing foundation. As is described in the community resilience component subsection this result in an unstable foundation of the house. Although the level of self-efficacy is similar in the Sreepur and Malbhanga community, the insufficient repairs have a higher impact in the Malbhanga community than in the Sreepur community as the houses are more damaged.

4.3.1.4 Fish culture implementation error

Observations of the Sreepur community show another interesting 'zero learning' situation: there is an empty pond in the middle of the community. This pond has three walls and one opening to the field side, which creates water easily going in but also easily going out. In the dry season the community inhabitants have no access to a nearby water body to start cultivating fish. The trainings given on fish culture have therefore no use outside the monsoon. The interviews show that the only people who are fishing in the seasons besides the monsoon are the ones who are culturally more attracted to eating fish; the Hindu families (Annex 1). These families are fishing in the nearby river.

The problem with the pond could have been foreseen by the project; they could have added a fourth, somewhat lower, wall to the pond to keep the water inside when the flood is over (Observations). Especially when considering climate change, which will put more pressure on the community. During the predicted more extreme droughts this pond is of high importance to create a secure income source for the inhabitants of the Sreepur. The inhabitants of the Sreepur community have not thought of adding a fourth wall to the pond. This could be because of their already fulfilled need for additional income or it could be because they are not interested in cultivating fish. Besides, ignorance could be a reason, as the project did not teach them how to create a useful pond. Moreover, lacking of self-efficacy and a problem-focused coping style regarding the drought could be another reason for not changing the pond into a more productive one. While I observed another place where they do practice fish caging (figure 9) I do believe that the Sreepur community should benefit from this income source. As the practice is not labor or cost intensive I would highly recommend the Sreepur community to consider the possibility of executing this practice. However, my knowledge on creating ponds is insufficient to say that a pond can be created considering the depth of the pond and the dryness of the ground.

Figure 9: The practice of fish caging in a community near to Rangpur.

Comparing the situation with the Malbhanga community I would say there is a little difference, in the Malbhanga community there are lower laying areas where a pond could be created. However, according to the inhabitants of the Malbhanga community the drought season is too intense and they therefore have no water left in their ponds. No solution for this problem has yet been found.

4.3.1.5 Keeping the chickens cool

To keep the cattle cool is one of the instructions of the project. The situations in which this was implemented correctly are described in the next section, single loop learning. However, keeping the chickens cool was not fully implemented and is therefore categorized as zero learning. In order to keep the chickens cool they should stay inside the houses during hot days, is what the project recommended. The interviewees told me that they were keeping their chickens inside their houses.

However, while I was doing interviews in the community during the dry season at the hottest time of the day, chickens were walking around outside the houses all the time. And when interviewees showed me their houses I never saw a chicken sitting inside their houses (Observations). This could mean that even though they know better they do not feel the pressure to actually keep their chickens inside, or it could mean that they are not willing to keep their chickens inside their houses. The lack of pressure can be a result of low interest in what the outcome will be as they have now enough money to survive with or without the survival of their chickens.

But what seems more reasonable is that they did not want the chickens in their homes. This could explain why the chickens in the Malbhanga community were also walking outside, while the inhabitants of Malbhanga do not have enough money and are depending on the income the chickens create. However, the lesson was to keep the chickens cool which could also be in a spot with shadow. In the Sreepur community there are many trees which create shadow, but no particular shadow spot has been set up to keep the chickens. The same goes for Malbhanga, which also has no particular shadow spot for chickens, however, they do have little sheds for chickens (figure 10). These sheds are used to create shadow and to keep the chickens warm during cold shocks in the winter. Although the idea seems good the implementation fails; during the summer the houses are used for straw storage and during the winter the chickens still face problems as they starve while they do not go out of the warm shed to search for food (Annex 2: Interview 5, 6, 7, 8).

Since climate change is causing more extreme droughts, and thereby more and extreme hot days, the community inhabitants should take measures to protect their chickens from the heat. Until now the implementation of the measures have failed in both communities. For Malbhanga it can be the result of a lack of information about healthy conditions for chickens. And for the Sreepur community it could be a lack of healthy solutions offered by the project. In Malbhanga single loop learning occurred when they built the sheds for the chickens to keep them warm during cold shocks, however, it did not work out successfully and they are now going through zero learning by not changing their actions. In the Sreepur community no single loop learning has been involved in this process, as they did not change their actions when chickens became ill. The Sreepur community is therefore going also through zero learning.

It is debatable whether the inhabitants of Sreepur are having a high self-efficacy considering keeping the chickens cool, as they might also already be satisfied with the results. Since the result is that not that many chickens become ill, they might think they are already doing a good job. The latter might be the case, however, they still could make improvements in my perceptions by creating a cool spot for their chickens.

Figure 10: Little shed for chickens in the Malbhanga community. On the right the chicken shed is used for straw storage.

4.3.2 Single loop learning

Problems which are not ignored as the problems described in the zero learning section above, are divided in three sections: Single loop learning, double loop learning and triple loop learning. In this section the effects of the project on single loop learning are evaluated. The single loop learning problems are problems which are solved without changing the objectives of the actions or routines, only corrections and improvements are made for a better outcome. It can be seen as reacting on the problem by changing the action (IPCC 2012). When the outcomes of an action are disappointing the person could ask himself *'Am I doing it right?',* at this point the person is going through single loop learning. While going through this learning process the person has a high self-efficacy, as it believes it can improve the action. Compared with double loop learning, which actively tries to change the frame of the action to solve the problem, single loop learning is a less problem-focused coping style as it only reacts on the problem.

4.3.2.1 Three ways in making cattle breeding more efficient

Cattle breeding is a good example of single loop learning in the Sreepur community as the community inhabitants keep improving the conditions of their cattle. The project gave the community a communal shed and the poorer families a goat or sheep to start with. Adding on to this, the project gave them instructions in how to save money and how to invest it. Soon the community inhabitants realized the benefits of investing money into cattle as the cattle provides more output then input in terms of money. This proves that the inhabitants have a high self-efficacy, as they believe they are able to improve the action. Improving this action is highly important regarding the upcoming extreme seasons and weather events caused by climate change.

At first, the community inhabitant started to buy more cattle and poultry from saved money or from the profit they made from their sold cattle (Annex 1: Interview 3). Since the cattle and poultry were

easy to breed and to maintain they increased the amount of cattle and poultry to gain more profit. In this way the community inhabitants improved their outcomes without changing the objectives or underlying values and norms. This new or increased income creates more security for example when climate change surprises the community with an early monsoon.

Second, as the amount of cattle and poultry increased the animal diseases became well known amongst the community inhabitants. Cow breeding and fattening was sometimes hampered by hoof diseases, which created blisters on the feet of the cow. This disease was caused by the concrete underground of the community shed. While the shed was keeping the animals cool it was also harming their feet. Therefore, community inhabitants with enough savings build their own shed for their cow on normal ground (Focus group). They changed the conditions for their cow to live in and took away the risk of getting the hoof disease.

Not only cows received better treatment also the life of the ducks improved. During hot days in the dry season the ducks are more vulnerable to diseases. To cool the ducks the community inhabitants make little pools of water for the ducks to swim in (Observations). Thereby, they are reducing the risk of the ducks to get diseases and thereby improving their outcome. This was also planned for the chickens, only the chickens must have stayed inside the houses to avoid diseases. However, this was unfortunately not implemented well enough as is described in the previous section on zero learning.

Third, during flood and the dry season there is little space to feed the cattle as grazing is not possible due to water on the land or the little amount of grass left. To solve this problem the community inhabitants are buying additional straw, to keep their cattle from starvation during flood. Although this straw is expensive the community inhabitants still have a more profitable situation by keeping their cattle well fed during flood time (Annex 1: Interview 3). This example shows that single loop learning does not always involve innovative measures, in this case it is just learning how to better invest the money you have to gain more profit.

The situation in Malbhanga is different as they do not always have enough money to buy straw for their cows during flood (Annex 2). They try to improve the situation by feeding their cattle with banana tree leaves but most of the times the cattle suffers from starvation. While there are other strategies used in the Malbhanga community, like taking a loan to feed the cattle, the lack of money and resources puts them in a difficult situation in which they have no idea to get out.
Although the Sreepur community has an advantageous position considering being able to care for their cattle, differences between rich and poor are present. While the rich have their cattle in a private shed with good ground and always sufficient amount of food, the poor keep their cattle in the community shed and face problems to feed their cattle in times of drought and flood. This difference in resource equity can influence the community resilience to climate change as a whole. When not all the inhabitants have high resource equity, the degree of community resilience becomes lower. Although, this particular difference in resource equity will not make a difference when climate change causes stress in the lives of the Sreepur inhabitants, it can create less beneficial circumstances regarding the income. In this case it would be that the cow gets ill which lowers the profit from the cow, and with this lesser profit the resilience to climate change becomes lower.

Inequalities also exist in the Malbhanga community, which seems to have no influence on the situation during flood when they are living in an up to one meter high water level. Since all the families make their own raft and take care of their own housing, people do not undertake collaborate action. The Sreepur community does not have to flee from the flood, therefore the degree of collaboration is hard to examine. However, they seem to help their neighbors in times of food stress or diseases. The prospect of the changing climate and the increased amount of stress in the Sreepur community could cause more depletion of resources which could eventually lower the resource equity and thereby lower the community resilience to climate change. Therefore, it is important to reduce the keep increasing the resource equity in the Sreepur community.

4.3.2.2 Irrigation to improve agricultural work

In both communities they use multiple crops for their land, as the land is very fertile. However, in Malbhanga the crops often fail due to lack of irrigation; which means a lack of money or problems with irrigation. In Sreepur they have no problems with irrigation, although they also experience increasing costs. The dry season is getting more extreme every year, therefore, a few years ago, they started with irrigating their lands before plowing as it was otherwise impossible to plow the ground (Annex 1). This implies that they improved their method to retrieve the same outcomes. However, if they learned this from the project remains unclear. The inhabitants of Sreepur have a higher income which they can use to invest in more irrigation. This investment is something they learned from the project but it remains unclear if the use of more irrigation, to increase the yield, has been instructed by the project.

Comparing this with the Malbhanga community, where they have not that much money to invest in irrigation, Sreepur can make more use of irrigation (Annex 2: Interview 10). This is a type of single loop learning which is not very innovative but does has beneficial impact on the agricultural income of the Sreepur community. In Malbhanga the inhabitants sometimes are forced to take a loan to be able to irrigate sufficient enough, this makes them financially more vulnerable and thereby less resilient to climate change.

4.3.2.3 Housing

Although the inhabitants of Malbhanga have no raised community platform, like the inhabitants of Sreepur, families in Malbhanga do raise their platform from their houses. This creates a higher chance of being able to stay at home during flood. Halve of the time this works out which implies that they learned to cope with flood by making their houses more efficient protected to flood. This platform consists of earth and clay (figure 11). Since the material is not fully resistant to water, the flood often causes breaks in the platforms. The breaks are repaired by the families themselves and when necessary they get professionals to help them. However, they rather repair it themselves, even if the repair is thereby done improperly, since they have to take a loan to pay the professionals. Besides saving money, the families in Malbhanga show a relative high self-efficacy when they decide to repair their houses by themselves. In figure 12 is a raised platform shown, which is observed as a common tool to protect houses from flood in the whole Gaibandha district of Bangladesh.

Figure 11: A house in the Malbhanga community on a raised platform.

4.3.3 Double loop learning

Double loop learning goes one step further then single loop learning; it does not focus on the efficiency of an action but on the effectiveness. When the people in the community go through double loop learning they do not only search for more efficient actions or tools to achieve the same outcome, they also examine the appropriateness of the currently chosen outcomes. Thereby they are changing the frame of the action. People going through double loop learning ask themselves '*Are we doing the right things*?'.

In the Sreepur community some activities are suffering from climate change in such a degree that little improvements to only change the action, like in single loop learning, are not sufficient enough. Therefore, the inhabitants of the Sreepur community take actions in changing their lifestyle to become more resilient to climate change. This requires an even higher self-efficacy of the community inhabitants than when they are going through single loop learning. And while they are actively changing their frames to be better prepared for climate change, they also have a more problem-focused coping style by taking more time to change their situation regarding climate change. This goes a step further than single loop learning, as with double loop learning people put more effort in tackling the problem by not only changing the action but also the frames where in this action takes place. In the following activities the role of double loop learning, and the thereby higher self-efficacy and more problem-focused coping style, are analyzed.

4.3.3.1 Improved transport during flood

The project installed a boat in the Sreepur community as a mode of transport during flood since the community becomes an island during flood times. Unfortunately this boat broke after a few years without any chance of getting repaired for a payable price. Without any boat the community would suffer from a transport deficit as they would depend on other boats which pass by. Therefore, the community leader, whom is chosen by the community inhabitants through the process of the project, invested money in a new boat which is used to transfer the community inhabitants. In order to get money back from his investment the community leader receives a yearly amount of money from the community inhabitants; each family pays 500 taka. This amount is reasonable for the community inhabitants as they would otherwise have to pay for each trip they make and would be highly depended on boats passing by. The community leader does make profit in this situation which he uses as income during the flood. Additionally to the yearly payments the community leader also

permits people from other communities on the boat, they pay a little fee every time they use it (Focus group).

During the first days of the flood the boat is merely used to rescue people from drowning or other disastrous situations. In this time the volunteers, from the volunteer committee, of the community are helping on the boat to help with rescuing. They are helping the most vulnerable people of their own community but also those from other communities. The existence of the volunteer committee is already positively influencing the degree of resilience, as people feel attached to this committee, however, in times of disastrous situations it helps vulnerable people to become more resilient to climate change as well. The degree of community resilience to climate change increases as a whole when the vulnerable inhabitants of the Sreepur community are becoming more resilient to climate change as well (Focus group).

The boat is a personal double loop learning experience for the community leader as the boat is still functioning but in another setting, with different means and different values. The value of a boat being from the community is unfortunately gone. This could mean that the sense of belonging in the community is less, because the boat not being a part of the community and the attachment to the boat is little or nonexistence. The resilience to climate change is thereby lowered. However, the community members perceive the community leader as a trustworthy man whom is willing to help everybody (Focus group). This is in line with the function of the community leader, described in chapter two, which states that this person should be trusted by the community and has organizational skills. The community voted for this community leader as the project encouraged them to use voting. This makes the community leader role stronger than if he was not elected to play this part. Now the community leader feels responsible for his action and is constantly involved in the community. During the interviews I observed a fight between two community inhabitants which was solved thanks to the community leader (Observations).

Since the community leader is perceived as trustworthy and a neutral person who is able to lead the community, the community inhabitants do not perceive him as someone who is trying to get as much money as possible by letting others pay for his boat. In contrary, they believe the yearly price to use the boat is reasonable. As long as this perception remains the community resilience would not have to be damaged.

In the Malbhanga community there was never such thing as a community boat, and there is no boat owned by the community leader. In Malbhanga each family makes its own raft to transport them to the shelter (Annex 2, Focus group). Making this raft costs a lot of energy and time, therefore the community inhabitants are hoping on less flood so they do not necessarily have to go to the shelter. This is not only because the raft making is hard, they are also very attached to their homes and their privacy, something which is very scarce in the shelter (Focus group). Without having any boat, owned by a community member, who organizes some kind of transport, the inhabitants of Malbhanga have more trouble with transport and communication than the inhabitants of Sreepur. They have not learned how to make a boat, or how to save money for a boat, which shows a lower self-efficacy and thereby a lower degree of community resilience.

4.3.3.2 Creating better housing

The project of Practical Action had a strong focus on creating new housing for the new community inhabitants. The houses are made of brick with a tin rooftop, which is capable of surviving storms. Although the inhabitants of the Sreepur community are still very grateful for their houses, they are making adjustments to their houses (Annex 1, Observations). These changes are made by going through double loop learning and are evaluated below as house extensions.

Since the creation of houses and the material of the houses were costly for the project, Practical Action wondered if these houses fulfill the needs of the inhabitants. And by examining if the Malbhanga community would be willing to partly pay for such a house, Practical Action can decide whether they want to implement the creation of such housing again. Therefore another subsection, on the need for such housing, is added to this double loop learning subsection.

4.3.3.3 House extensions

Housing has been an important element of the project, however, it is an element which is continuous evolving to fulfill the needs of the owners. And as needs are increasing simultaneously with income, the houses are constantly improved. Therefore, the project could not have known about all the wishes the community inhabitants of Sreepur nowadays have.

The houses of the inhabitants of Sreepur have changed in its use, it is not only used to sleep and to live in but they extended their house to have a multifunctional house. The value of the house changed as it now functions with a different purpose. Three kinds of house extensions are in place. The first kind of house extension is private cattle shed. They made sheds from straw and sometimes tin to protect their cattle from the sun, which is going to be more important when climate change is causing more extreme droughts in the near future. These private sheds also protects their cattle from hoof diseases, as described earlier, which could create more certainty of income and thereby increases the resilience to climate change. Some of these sheds have also a place for the children to sleep in, not because these children cannot sleep with their parents but because they function as a guard for the cattle, which can otherwise be stolen during night times (Observations).

In Malbhanga there are also some private sheds, but every time when I visited the Malbhanga community the cattle stood outside in the heat of the sun (Observations). This could be because the inhabitants of Malbhanga are not aware of the effect of the heat on their cattle, or it could be more convenient to feed the cattle outside as the straw was already lying outside. In figure 12 some examples are shown of cattle outside in the heat of the sun in the Malbhanga community.

Figure 12: On the left a cow tied up outside in the heat of the sun. On the right calves outside in the heat of the sun. The calves on the right are attracted by the food which lies in the heat of the sun. Both pictures are taken in Malbhanga.

The second kind of house extension does have something to do with a lack of space; the extension of their house for a growing family (Annex 1: Interview 6, 7). In Bangladesh it is common that when a son gets married he and his wife move in with his family in his family's house. This can cause a lack of privacy or simply a lack of space for people to sleep and live. An extension of the house is therefore made in form of a tin or straw made shed. Some families have also made an extra house of tin to give space to this new family generation. These houses are not as good as the houses made of brick but they give sufficient protection against storm and when it does need repairing they can often repair it themselves (figure 13). These houses are similar to the best available houses in Malbhanga, which shows that these houses are common used in Bangladesh and it shows that the inhabitants of Sreepur can spend the same amount of money on their new generations as the relatively rich inhabitants can spend on their housing for their whole family.

Figure 13: House extension for a growing family in Sreepur.

The third kind of extension for their house functions as an extra income source or is used for own consumption, this is a vegetable garden on an extended roof or shed. This provides the family with additional food and is often shared with the neighbors (Annex 1: Interview 8). This also goes for the fruit trees in the community (Focus group). This additional food can create more space for the family to save money, as they do not always have to spend it on food. Some inhabitants complain that now they have so many trees that they cannot have any vegetable garden on the ground anymore. However, they do realize that the trees are providing them with fruit and shade. The latter is of high importance regarding climate change, which will cause more hot days. In the Malbhanga community there are also fruit trees and people are also using their rooftops as vegetable garden (Observations). The food is also shared in the Malbhanga community and the shade is also very beneficial for the community regarding the heat (Focus group). Comparing Sreepur with Malbhanga there seems to be no difference, which indicates that this kind of house extension is common in Bangladesh or it can indicate that Malbhanga also learned how to improve their situation regarding climate change.

Compared with the Malbhanga community people have same kind of house extensions only the differences between the material used for their houses and their house extensions are less visible (figure 14). To rear cattle they have sometimes little sheds, but the cattle are mostly outside where it suffers from the sun (Observations). A growing family means a new house should be built, the material used is depending on the income of the family. However, a growing family often stays in the same housing which makes the houses extra occupied (Annex 2). Vegetable gardens are everywhere, this could be a small tree in from of their houses or an extension of their rooftop to grow vegetables on (Observations).

There is no direct influence of the project on their house extensions, the inhabitants of Sreepur did go through double loop learning but this has little to do with the project. The house extensions are more a response to the need for more luxury. The inhabitants of Sreepur want to have more space and more privacy and thanks to their higher income they have more properties, which they want to put up somewhere. Each generation wants to have their own homes and thanks to the increased income they can create their own home with more privacy. The need for more luxury originated from the higher income they received after applying the lessons from the project. Although the need to have more space and more privacy originated from the project, the tools to create house extensions did not arise from the project.

The link between the direct effects of climate change and house extensions only goes for the need to keep the cattle in a cool place during the dry season and keeping it warm during the cold season. In the Sreepur community more places for cattle are reserved, which indicates that they are more prepared for climate change and went through double loop learning to create this situation. The other ways of house extensions having only effect on the indirect effects of climate change. The house extension for a living place of a new generation creates less distance between families which improves the communication during flood. And since there are no multiple generations in one house there is more space to relax during times of stress. Besides, people who search for shelter could shelter also in their houses, as they have sufficient space. The house extension for vegetable production creates a more secure food intake, however, this vegetable garden could also be damaged by climate change. Therefore, this kind of house extension has little effect on the community resilience to climate change.

Figure 14: House extensions for cattle, on the left Sreepur, on the right Malbhanga.

4.3.3.4 A strong house for storm protection

The need for a brick made house is questionable as the houses in Sreepur have many straw and tin made extensions and the doors and windows need to be repaired. Therefore, I asked the inhabitants of Malbhanga if they would want a house made of brick and what they would be willing to pay for such a house. They told me that they would want a house made of brick but they are already quite satisfied with their tin-made house. Since their income does not permit building a house from brick they are willing to take little loans and pay up to 40% of the house costs, the other 60% must be financed by a project (Focus group). This shows that there is a need for a brick made house but not against all costs.

Not only did the outside of the houses change, also the inside of the houses changed. As they received an empty house from the project no luxury was implemented. At first all the families slept on the floor, however, after some practice the community found out a way to build a bed. A bed brings comfort to the families as they are now more separated from insects and dirt on the floor (Focus group). Most of the families have a bed, which is made of wood and does not involve a mattress only some fabric to cover the wood (Observations). The same development is shown in Malbhanga, where most of the families also have beds (Observations). Therefore a dependency on the project cannot be claimed on how they changed their housing.

The luxury in their houses is indirectly beneficial regarding climate change. Since climate change is creating more hot days and more extreme cold shocks in the future, it is important to have a healthy way of living. This healthy way of living starts with a proper house in which the inhabitants can take rest properly. Building a bed is necessary for taking rest properly, so in that sense it is indirectly influencing the way the inhabitants of Sreepur and Malbhanga cope with climate change. Building a bed or creating a more luxurious lifestyle can be seen as learning how to change the frame of actions in the household of the inhabitants of Sreepur and Malbhanga. However, with learning people are improving their actions as the outcomes of the actions were unintended. The latter is not the case, which indicates that having a bed or a luxurious lifestyle does not mean that a person is learning and thereby does not necessarily increases its resilience.

4.3.3.5 Creative ways of agricultural work

Since standard agriculture seems to become less profitable, due to the more extreme drought which is caused by climate change, two creative ways of agriculture are introduced by Practical Action: Sandbar cropping and floating garden. These two creative ways, changed the practices of the inhabitants of Sreepur and the framework with its value for sandy land and flood.

Sandbar cropping is cultivating on sandy land. The method of sandbar cropping explained in short, put seeds in 10 kg of fertile ground, which is put in a 1 meter deep hole in sandy land and irrigate the ground until you can harvest. This technique is used during the dry season. The inhabitants of the Sreepur community learned how to cultivate pumpkins on sandy land nearby the river (figure 15).

While executing sandbar cropping the inhabitants of Sreepur learned to add more fertilizer and more irrigation to increase the size of the pumpkins; they thereby improved their outcome. More and more people are using the sandy land to cultivate pumpkins (Focus group). Their improvements are an example of single loop learning, however, the inhabitants changed the frames of sandy land from being not useful to being very useful which indicates they went through double loop learning.

This sandy land is owned by the government and is lend to Practical Action and other implementing NGOs in this area. These NGOs are looking for possibilities to persuade the government to set up a system in which the rural population can make use of sandy land freely. Until now this is not the case.

Figure 15: Sandbar cropping, after harvesting on sandy land in the Gaibandha District.

Since the water flow between India and Bangladesh is currently influenced by political interest. India is trying to cope with the drought by keeping the water in their own country and not opening the dam to provide the rivers in Bangladesh with sufficient enough water. Although this political situation can be temporary, with climate change putting more pressure on India these situations might occur more often in the future. Being creative within the agricultural work is therefore of high importance for the agricultural sector in Bangladesh. Sandbar cropping is one of these creative solutions to cope with the problem of having less water available.

The use of floating gardens is mainly during the floods in the monsoon season. A floating garden is a vegetable garden on a terrace of water lilies. The vegetable gardens are not designed to be big but

are mainly for own consumption. Since there is little land available during flood the floating garden offers space to grow crops on the water. The inhabitants changed the value of the flood from having no opportunity to cultivate, to having opportunity to cultivate and feed the family.

The use of the floating gardens is increased as the number of users grew from 15 workshop participants to 20 cultivators nowadays. At first the floating gardens were used around the community in Sreepur, however, the community surroundings provided no sufficient conditions to continue this activity. One of the lacking conditions was the lack of land surrounding the floating garden which should keep it at its place and which should stabilize the water flow. Therefore, they moved their floating garden to the embankment; one kilometer away from the community. Here the floating garden is more stable and is less vulnerable to fast streaming water. Another adjustment is the additional banana tree leaves which are added to the floating garden beds to increase the size of the garden and the stability (Focus group). With these corrections and improvements of their action they can keep harvesting vegetables during flood time, some even have extra vegetables which they can sell at the market place to receive additional income. This shows that they went through single loop learning as they made their action more efficient.

When comparing the Sreepur community with the Malbhanga community on having additional agricultural income by executing a creative practice such as floating garden and sandbar cropping, the Sreepur community is ahead of the Malbhanga community. This is mainly a result of the project, as the project taught the inhabitants of Sreepur how to implement these creative ways of agriculture. Unfortunately, the Malbhanga community has not been introduced to either of these creative ways of agriculture.

4.3.4 Triple loop learning

Triple loop learning, as described in the theoretical framework, is about becoming aware of learning processes such as single loop learning and double loop learning. People going through triple loop learning are able to identify how and when they are learning and how and when they are not learning and then adapt to the situation. It triggers changes in underlying norms and governance structures. By going through triple loop learning the community should transform the context in which contains frames of the actions that have to change when coping with climate change. The question people ask themselves during this process is '*How do we decide what is right?'*.

In the Sreepur community people are aware of their improvements on income and housing but not so much on the manner of their improvements. When asking if they learned something themselves after the project only few know how to answer the question. This could have been a result from the lack of knowledge about words which were used during the interview. However, when the question was framed differently like: '*What did you learn yourself?'* or '*What did you learn by doing?*' people were able to answer. Answers to these questions are discussed in the previous sections on single loop learning and double loop learning. However, the awareness of the way they learn remains absent.

Only one activity seems to be the result of people going through triple loop learning, which is the shift within agricultural work.

4.3.4.1 Shifts within agricultural work

The only aspect of the Sreepur community which reflects triple loop learning is the shifts in agricultural work. Although it is questionable whether this changed practice can be fully considered as triple loop learning, it definitely goes a step further than double loop learning, in which people only change the frames of their actions.

As a result of the project, community members received training in how to do agricultural work and how to save money to buy your own land. Due to these knowledge and skills, other people had more trust in the community members to cooperate. While before the project many inhabitants were involved in agriculture day labor, nowadays the landowners trust them more and therefore they are involved in: Share cropping, land owning and leasing land/mortgage land. This kind of trust changed the context for the Sreepur inhabitants, and thanks to this trust they are able to expand their agricultural businesses and thereby changed their practice.

The inhabitants of the Sreepur community have more owned land and are more involved in share cropping then the inhabitants of the Malbhanga community (Annex 1, Annex 2). More inhabitants of Malbhanga are still depending on agricultural day labor and are thereby not improving their income in the long run. Adding on to this, when flood comes there is no sufficient work in agricultural day labor. This makes them vulnerable for climate change and its indirect effects on their health (Annex 2). The inhabitants of Malbhanga need to get treatment because they have no sufficient food and they are starving themselves (Annex 2: Interview 3).

By using different structures to receive more profit from agricultural work, the Sreepur community changed its effectiveness of agricultural work. They changed from working for a landowner to becoming a landowner and having their own agricultural day labors (Annex 1: Interview 1, 9, 10). This was only possible thanks to the increased trust they received from landowners after being part of the project. And since the Sreepur inhabitants, who became land owners with agricultural day labors, know what it is like to be an agricultural day labor, they perceive themselves as better bosses. Whether this is true is questionable, however, the landowners of Sreepur feel satisfied with the thought of providing work for the relatively poor people whom are in high need of an income.

The inhabitants of Malbhanga have less owned land on average and most of this land is useless to them as it is sandy land. Combinations in share cropping and agricultural day labor as income exists in both communities, however, in the Malbhanga community people with share cropping land are perceived as rich and in the Sreepur community people with own land are perceived rich (Annex 1, Annex 2). Therefore, the income resulting from agriculture is growing more in Sreepur, where people in five years grew from agricultural day labor to land owner with agricultural day labors. The inhabitants of Sreepur changed their structure and their position as agricultural day labor totally. They learned how to transform their situation in a fundamentally new system. Their situation changed from having a boss to being their own boss. This transformation is linked to triple loop learning in chapter two. People going through triple loop learning question themselves: *How do we decide what is right?.* This question is not necessarily answered by the inhabitants of Sreepur whom became their own boss. However, they are conscious about the way they treat their employees and how they can offer them a secure income. And although, they involved other people, whom are now their employees, in their transformation, it does not fulfill the requirements of going through triple

loop learning. It could be that these inhabitants of Sreepur are now going through triple loop learning, when they question the rightness of them being the boss of relatively poor people. Unfortunately the interviews were not sufficiently in-dept to find out if these people are indeed questioning themselves.

4.3.4.2 The project as a whole is a triple loop process

Whereas it remains uncertain if the shifts within agricultural work are a result, or is creating, triple loop learning, the project as a whole can be seen as triple loop learning.

Although the Sreepur community did not transform in such a way that the context changed of their whole community, at least they did not change the community themselves. The project did change the lives of the Sreepur inhabitants and thereby the context in which they live in. It did not only changed their live by making it better, which is single loop learning, and it did not change their lives by giving them another source of income, which is double loop learning, it changed their way of living including being part of a solid and attached community. Before the project the inhabitants were on the lowest level of the social ladder and were living day by day. Now the inhabitants of Sreepur have more equality in their community and can think about long-term plans and goals. This is difficult to compare with the Malbhanga community as this community exists over 60 years and has not gone through such a change.

4.4 Conclusion: Impact of the project

The project had effect on the community resilience of the Sreepur community in different ways. The main impacts are on both components of community resilience to climate change, which were taken into account in this evaluation: Community resilience and learning. The main impacts of the project on the community resilience in the Sreepur community are the high resources equity, access to facilities and the sense of belonging through community buildings. The main impacts of the project on learning of the Sreepur inhabitants are:

- Community resilience: Sense of belonging;
- Community resilience: Resource equity through housing;
- Single loop learning: Increase of income;
- Double loop learning: Creative ways of agriculture;
- Triple loop learning: Shifts within agricultural work.

These impacts have either a direct or indirect effect on how the inhabitants of Sreepur cope with climate change. Unfortunately not all the action, frames and contexts are changed to better cope with climate change. Many zero learning processes are found as well, which could have been avoided by the project. There the main impacts are different from the five key findings of this project evaluation. The five key findings are: The high resource equity, the sense of belonging, zero learning, learning through income, and the changed practices.

The project was highly beneficial for the inhabitants of Sreepur, however, some improvements can still be made. For example, solutions for the repeatedly failed amon rice could be provided. Although knowledge and skills of other creative ways of doing agriculture were offered, it does not take away the fact that their standard agricultural income is decreasing due to lack of knowledge on more effective substitutes. The fact that the houses are degrading and there is no knowledge on how to

repair the houses properly is another error of the project, which did not teach the inhabitant about proper repairs. Every house requires maintenance and the Sreepur inhabitants should be able to do little repairs themselves in order to save money and to be more independent. Currently, the inhabitants of Sreepur do not know how to repair their doors and windows and this results in badly constructed parts of the house. Another problem which could be foreseen by the project is the implementation error of the fish caging activity. With an extra wall in the pond in the middle of the community they might be able to execute fish caging, which is now not activity of the community inhabitants.

Some parts of this project evaluation were uncertain as it required more background knowledge on the culture of Bangladesh. According to the local staff of Practical Action the willingness to help each other is always high in Bangladesh. According to my experience the local staff of Practical Action could be right. Everywhere I went in Bangladesh I received more help then I needed and people always took time for me make sure I would be all right. However, the fact that I had a Western appearance could have played a big role in their willingness to help me. Since my stay in Bangladesh was relatively short I could not be certain about the latter statement. When comparing the willingness to help each other in Bangladesh with Western countries, I could say that Bangladesh has a much higher willingness to help each other.

5. Reflection on the community resilience outcomes

The findings in the previous chapter show that community resilience to climate change has increased as a result of the project *Disappearing Lands* from Practical Action. The key findings are: The high resource equity, the sense of belonging, zero learning, learning through income, and the changed practices. The aim of this chapter is to reflect on these results in two ways. The first is a comparison of the short-term outcomes and the long-term outcomes of the project *Disappearing Lands.* The second is a comparison of the key findings from my project evaluation of the project *Disappearing Lands* with other project evaluations of other projects from other NGOs in Bangladesh.

The differences between the short-term outcomes and the long-term outcomes show the implementation errors and the growth of the implementation. When an activity or installation is no longer active or in use, the implementation of the project on this particular element was not successful. The other way around, when an activity or installation has further developed there was growth of the project element. The latter could be seen as a learning process, which could be single loop learning, double loop learning or triple loop learning. In this learning process the community learned how to improve an action, increase the value of an implementation or change the whole context of the action as a result of what they learned or experienced from the project. From the comparison between the short-term and long-term outcomes, recommendations on the implementation and aftercare can be made. These recommendations can be found in next chapter, the conclusion. An additional reason for this comparison is to validate the evaluation outcomes by finding confirmation of the project's effect on the degree of community resilience to climate change of the Sreepur community. When other implementations are mentioned than the ones which are described in the short-term evaluation, an intervening variable could be the cause for this difference. It is valuable to know if these differences exist, and thereby if there is an intervening variable, as the long-term evaluation can be strongly influenced by this.

Whereas the differences between short- and long-term project outcomes show implementation gaps, the difference between this project evaluation and other project evaluations show which project activities are in general providing which particular outcome. In this comparison the long-term evaluation of the *Disappearing Lands* project are compared with other climate change projects in Bangladesh. This comparison is based on the key findings of the project evaluation: The high resource equity, the sense of belonging, zero learning, learning through income, and the changed practices. The aim of this comparison is to determine whether the long-term project outcomes of the *Disappearing Lands* project are unique or whether these outcomes are common in Bangladesh. Moreover, it is interesting to see if there are similar project implementations which create the same outcome in terms of community resilience to climate change. With this comparison a step towards a generalization of the project evaluation of the *Disappearing Lands* project can be made.

5.1 Short-term vs. Long-term outcomes

There are two sources of the short-term outcomes used for this analysis: one from Rick Gregory (2009) and one from Practical Action. The first is an individual evaluator who was asked to do an independent evaluation on the project *Disappearing Lands.* He made an evaluation report based on the four objectives of the project. According to his evaluation the project is highly ranked as most of the objectives are largely achieved and some have also been exceeded. He attended several meetings and observed the project outcomes to provide an insight on how the outcomes were

established. His findings are not limited to the Sreepur community, as he evaluated the whole project including the four cluster villages and the embankment communities.

The second source is from Practical Action itself. In this evaluation report the scope is smaller, only focusing on the effects of the project on the Sreepur community. Therefore more details on the community are provided which are useful for the comparison. The evaluation of Practical Action is mostly quantitative while the long-term evaluation of this research is mostly qualitative, which creates difficulties when comparing. Therefore, comparing these evaluations is mostly used as a validation of the results and to show quantitative differences. Another critical argument is that the findings could be biased as positive findings are more beneficial for Practical Action. To account for these issues, the evaluation report of Rick Gregory is mostly used to create a reliable overview of the short-term outcomes.

The effects of the project are categorized based on the results of the previous chapter: The high resource equity, the sense of belonging, zero learning, learning through income, and the changed practices. In this comparison the results of the short-term evaluation of Practical Action and Gregory are defined as results from 2009 and the results from my long-term project evaluation are defined as results from 2014. After the comparison I describe the implementation gaps and the elements that I missed in my evaluation, which were present in the short-term project evaluation. A conclusion on the community resilience to climate change in the long term is provided at the end of this comparison.

5.1.2 Community resilience: Equality through resources

The key findings of the community resilience elements which were evaluated in the previous chapter are here compared with the short-term outcomes evaluated by Gregory in 2009. Two kinds of community resilience elements are evaluated: The high resource equity and the sense of belonging. This subsection compares the short-term outcomes and the long-term outcomes of the project *Disappearing Lands* on the key finding: high resource equity.

The houses, received from the project, created high resource equity among the inhabitants of Sreepur. This resource equity creates a more equal situation in the community in which people are more willing to help each other. This equity thereby increases the community resilience to climate change.

However, the received houses turned into a situation in which the inhabitant could have a learning process. Unfortunately, this was not the case. In 2009 comments were already made on the quality of doors and windows (Gregory 2009) which indeed appeared to be low as the doors and windows where to degrading in 2014. The inhabitants were not taught how to repair their houses. Nowadays, they repair it insufficiently which lowers the overall quality of their house. Regarding to the resilience this could mean that in the future more of the houses are degrading and the resilience to upcoming storms is decreasing over time.

The houses are one of the basic needs the Sreepur community received during the project. Next to that they got tube-wells, toilets and healthcare instructions. However, the community expected the project, even after implementation in 2009, to maintain the tube-wells and toilets. According to

Gregory (2009) the community seems to wait for the project staff to come and repair the tube-wells and toilets although there were no promises about the repairs. Nowadays, halve of the tube-wells are not in use because of arsenic water pollution and many toilets have become storage spaces. The tube-wells are not repaired or are not planned to be repaired, even though the inhabitants of Sreepur mention that they will call somebody if something in their community gets broken it does not seem to be the case for the tube-wells. The low use of toilets has a different reasoning, as is already mentioned in the previous chapter, which is the need for privacy. It seems that the project intended to increase the basic needs and provide the whole community with equal access to their needs but in the end it did not work out and the difference between relatively poor and rich is becoming more visible. However, the toilets can still be used by the people whom do not own a private toilet, this available access for the community inhabitants creates community resilience.

The healthcare system was tremendous according to Gregory (2009). However, in 2014 the healthcare system is similar to the control community Malbhanga. Although the Sreepur inhabitants tend to have lesser problems with paying for healthcare, the system is not different. However, while the Malbhanga inhabitants have to lend money to go to the doctor or hospital, the Sreepur inhabitants have sufficient income and assets to have access to the healthcare system without taking a loan. This creates a less vulnerable situation as they can get treatment when getting sick from the drought, which directly makes them more resilient to climate change.

Another basic need is education, which is enhanced by the project through the implementation of the community pre-primary school. While 44% children were enrolled in school before the project which already increased to 60% in 2009, nowadays all the children go to school and most of them also finish high school. Education will provide long-term effects which will show off in the next generation. This could change the whole community as the inhabitants will have an increased level of income. When all the children receive similar education they should have a more equal chance of getting a job, which creates equal situation and therefore more community resilience.

5.1.3 Community resilience: Sense of belonging

The sense of community has been largely increased by this school building and the other community buildings: community shed and community center. These buildings create an attachment to the community which increases the sense of belonging.

In 2009 the shed was observed as very important for the community as it increases an equal chance of cattle breeding amongst the Sreepur inhabitants. However, nowadays the families with a higher income level rather have their cattle in their private shed or at a spot underneath the trees as the community shed has a subsurface which increases the chance of getting hoof diseases. While the shed five years ago caused resource equity it now reflects the income variety of the Sreepur community. This can create a more clear division between relative rich and poor which could. However, having a private shed or not is not necessarily beneficial when climate change effects the community.

5.1.4 Learning: Zero learning

One of the key findings of the learning is zero learning. A similarity on zero learning in the Sreepur community, between 2009 and 2014 is the implementation error of the pond. The dry pond was

noticed by Gregory in 2009 and although Gregory made clear that this could be changed, nothing has changed. This shows that there is no learning involved regarding the pond and it's potential.

Besides the degrading houses, which were already mentioned by project participants in the short-term project evaluation in 2009, no other similarities are found. The reason for this could be that the inhabitants of Sreepur were not able to execute zero learning as they were not given any time.

5.1.5 Leaning: Learning through income

Income is an overlapping source of community resilience to climate change which entails many ways of positive influence. By creating more earning opportunities the income of the Sreepur inhabitants has been increasing day by day. During the interviews the interviewees mentioned mainly income as answer to the question what changed after the project *Disappearing Lands*. The increasing income is exponentially and as the Sreepur inhabitants learned how to save money they have no trouble satisfying their basic needs during extreme droughts and floods due to climate change.

The increased amount of cattle, since 2009, shows that the Sreepur inhabitants learned the benefits from cattle breeding and created an even more profitable situation. This resembles single loop learning as it creates a more efficient activity. These cattle are assets bought by saved money. While before the project only 5% had saved money and right after the project 44% (Practical Action 2008) my long-term project evaluation shows that this comes close to the 100% since almost all the inhabitants have cattle.

Overall, the income has been increased tremendously; while the average yearly income of the families was 20.000 taka before and 36.000 taka after the project, it nowadays is increased to a yearly average of 111.000 taka per family. This motivates the inhabitants of Sreepur to improve them more and with this higher yearly income they have more tolerance towards the upcoming climate change and would also be able to help others out in times of need. Besides that, they often have multiple income sources which create less resource dependency. This lower resource dependency creates a higher resilience to climate change as an inhabitant of Sreepur is less vulnerable to resource depletion by climate change.

Other positive influences of income on the resilience to climate change are:

- Less temporary migrating men although it is still a popular way of securing the family of a stable income.

The temporary migrating men have slightly been decreased since 2009. According to the Practical Action evaluation report the yearly average of 54 days of migration decreased after the project to a yearly average of 40 days. Nowadays more men have local income sources, however, temporary migration is still used. Unfortunately no quantitative data is available on the temporary migration rates nowadays. The inhabitants mention in interviews that they do not have to use temporary migration anymore. However, the ones who are using temporary migration for a more stable income were often not present at the community as they were on their temporary migration. Fortunately their relatives could explain, during an interview, what their income and situation was. With this

knowledge the interpretation can be made that the temporary migration has slightly decreased over time. And thereby is the vulnerability of the women slightly reduced which increases their resilience.

The reason for this slightly decrease could be the fact that families have more local earning opportunities, or it could be because the women of the families also create income by helping out with agricultural work and creating income through cattle breeding. The short-term project results show that 80% of the families have only one earning member. However, nowadays it appeared that more than halve of the families have more than one earning member.

- Increased use of healthcare facilities and no loans needed for simple treatments.

Although the healthcare system and the use of the healthcare system in Sreepur are nowadays not different from the Malbhanga community, they do have more money available for simple treatments. In 2009 the healthcare system improved and nowadays every inhabitant can pay for it. However, the inhabitants of Sreepur do have to take a loan when the treatment is more intense and costly.

- More social connections, networks and confidence: They are able to help out others and go to ceremonies.

Through their higher income other people trust them more which provide more confidence.
In 2009 the income level of the Sreepur inhabitants already has been increased tremendously. The original project objective was: People displaced, or at risk of being displaced by river erosion have alternative livelihood options (new income earning opportunities). This objective has been achieved according to Gregory (2009) and he mentions that the technological innovations implemented by Practical Action were cost effective and impressive. These innovations refer to the additional agricultural income sources sandbar cropping and floating garden cultivation, which are described in the upcoming subsection.

Knowledge of both activities was shared amongst the Sreepur inhabitants and other people outside their community, which indicates that people are willing to help others with creating more income. Thanks to sharing knowledge with people outside their community the network of the inhabitants of Sreepur started to grow in 2009. Nowadays, many people go to ceremonies outside the communities since they have social connections thanks to this knowledge sharing. With more social connections, the inhabitants of Sreepur can rely on more help in times of need, which is during the extremes caused by climate change.

5.1.6 Learning: Changed practices

The creative ways of agriculture to create more income, sandbar cropping and floating garden, are activities in which the inhabitants went through a learning process. Moreover, the number of people involved in the floating garden cultivation has grown from 15 to 20 inhabitants of Sreepur, which implies that the introduction to floating garden cultivation was successful. The same goes for sandbar cropping which has doubled its amount of executers. In time they learned how to make the activities more profitable by increasing the efficiency. They used more fertilizers and more irrigation for sandbar cropping which created bigger pumpkins and thereby a greater income. And they used banana leaves to make the floating gardens stronger to resist the unstable water flow. Both improvements can be seen as single loop learning, as they improved their efficiency. However,

learning how to create additional income with other tools and changing the value of sandy land and floods, can be seen as double loop learning.

5.1.7 Implementation gaps and missing elements

The implementation gaps are the elements which were implemented in the project but which are not in place anymore in the long term. These differences can be analyzed by checking whether the short-term project evaluation contains elements which are not present in the long-term evaluation. Two of these elements can be defined: Fish caging and weaving. Fish caging, as has been mentioned before, is not implemented correctly as the pond in the community does not contain any water. Moreover, the inhabitants of Sreepur do not feel able to execute the activity during the flood. With more instructions or with a better functioning pond, this implementation gap could have been prevented.
Another implementation gap is weaving. A few women of the community learned how to weave and could therefore be earning an additional income, however, they have no ambition to make a business out of it. It could have been better to emphasize more on the business side of weaving. However, there were no complains about this lack of emphasize. This can mean that the inhabitants of Sreepur are satisfied with only weaving for their own family, but is can also mean that the inhabitants of Sreepur have no idea what kind of effect commercialization has on their weaving.

The other skill training of the project *Disappearing Lands*, which are described in the project methodology in chapter 3, are not mentioned in the short-term project evaluation. Therefore, and because no inhabitant mentioned being part of such skill training, I assumed that these trainings were not implemented in the Sreepur community. However, it could be that they were implemented and thereby it could be that I missed out on valuable information.

The elements I missed in my long-term project evaluation are the ones that are included in the short-term project evaluation which have an effect on the community resilience to climate change. Since the short-term project evaluation was not solely focused on elements of community resilience to climate change, some evaluation topics do not necessarily have to overlap. Therefore, I only check the topics of the short-term evaluation which do have somehow a relationship with the community resilience to climate change. The one topic that is missing is the use and ownership of a mobile phone, which makes communication easier and can therefore, is of high importance during extreme weather events. The lack of communication during flood is something the inhabitants of Sreepur and Malbhanga mention as a problem when somebody gets ill or the inhabitants need any help. Therefore it is an element of community resilience to climate change as it improves their ability to retrieve help in times of need. This topic is something which is not mentioned in the project evaluation, however, this is because all the inhabitants of Sreepur have their own mobile phone and it therefore calling is not a problem anymore. That could be the reason why this topic did not come up in one of the interviews. I perceive the mobile phones as a need for more communication, also during flood, however, I also perceive the mobile phones as a luxury. Although the inhabitants of Sreepur have a mobile phone, the physical communication and the transportation which is needed thereby, are still hampered by the fact that they are relying on boat transport.

5.1.8 Conclusion on community resilience in the long term

The income has increased through learning in the long run; from a yearly average of 36.000 taka to a yearly average of 111.000 taka. This has been improved through single loop learning and double loop learning, as the Sreepur inhabitants made their actions more efficient and changed the frames of

their actions. The other learning elements are the replaced boat and the cooking facilities. The latter has been a learning process of the community but the replacement of the boat implies that the community is lesser connected. The community resilience elements show two sides; a reduced degree of community resilience and an increased degree of community resilience. The reduced degree of community resilience involves the degrading housing and greater division between relative poor and rich. This also shows that they are not able to learn how to repair their houses sufficiently, which inhibits the community resilience. The increased degree of community resilience involves the increased use of healthcare and school enrollment. Although the healthcare and school enrollment do increase their community resilience, in the long term the community did only learn how to be more resilient to climate change in an indirect way. This means that an improved healthcare and education system creates better chances for the inhabitants of Sreepur to be prepared for climate change, by having a better job thanks to education or by being healthier to cope with droughts and floods.

The long-term outcomes have many similarities with the short-term outcomes. However, the differences between the short-term and long-term outcomes are crucial for the degree of community resilience. As resilience is a concept which entails continuous learning to adapt to the circumstances the long-term outcomes should show many differences with the short-term outcomes. The differences between the short and the long-term outcomes are:

- More difference between relatively poor and rich people;
- Higher income through learning;
- More efficient use of sandbar cropping and floating garden.

The first is unfortunately a negative difference between the short and long-term outcomes. This greater difference between the relatively poor and rich creates less community resilience. The second difference has changed many aspects of the lives of the inhabitants of Sreepur, which makes them more resilient to climate change. The third difference is interesting because the inhabitants did not only learn how to change the value of sandy land and flood, they also made the activity of sandbar cropping and floating garden more efficient.

Since learning plays a great role in the community resilience to climate change, it is important to do a long-term project evaluation which shows what the community has learned thanks to the project over a certain time period. It can be said that the long-term outcomes are therefore a better reflection of the actual effect of the project on community resilience than the short-term outcomes.

5.2 Comparison with other project outcomes

This subsection aims to put the results from the previous chapter, the effect of the project on the degree of community resilience to climate change, in a broader context by comparing it with other long-term evaluation studies from other NGOs in Bangladesh on projects that are focusing on climate change and resilience. The projects that are used are from different NGOs: CARE Bangladesh, Unnayan Shohajogy Team (UST), Rangpur Dinajpur Rural Service (RDRS), Eco-Social Development Organization (ESDO) and the World Food Programme (WFP). The first NGO is CARE Bangladesh, which is a local office of the international development organization CARE. CARE Bangladesh has implemented *The Reducing Vulnerability to Climate Change Project,* which ended in March 2006. The methodology and implementation was established after doing a vulnerability assessment, which

identified priority areas for the target groups. The project focused on the found priority areas that were connected to climate change and their effect on household-wellbeing. The priority areas were: waterlogging, salinity, flood and drought (CARE Bangladesh 2006).

The second NGO which is used to compare the results with is the Unnayan Shahojogy Team (UST), which is focusing on putting people's development in their own hands. The objectives of UST in the field of climate change is to help "improving of living conditions of poor marginal and small farmer households through enhanced, integrated and sustainable agricultural production" (UST s.a., pp. 43).

The third NGO involved in the comparison is RDRS which is working with 2.000 char communities in Bangladesh to enhance their capabilities to live with climate change and its related challenges. The project is called: *Poverty reduction through community-coping mechanisms addressing climate change adaptation/mitigation in northwest Bangladesh*. This project is focusing on providing tools to have an effective response to the reduced food security due to climate change. Activities undertaken in 2011 included: Construction, renewable energy, tree planting, homestead gardening, modified crops, food storage and coordinating disaster management (RDRS 2011).

While in 2011 RDRS undertook action to create more community resilience amongst the char communities in Bangladesh, in 2013 they aimed to help many poor people to adapt to and mitigate climate change. This project in 2013 was focusing on climate adaptation and mitigation activities such as: Drought- and flood-tolerant rice cultivation, cultivation of pumpkin on sandbars, alternate wetting and drying, renewable energy and homestead plinth raising (RDRS 2013).

The fourth NGO is ESDO which has been implementing four projects in order to build capacity of vulnerable communities and local institutions on disaster risk reduction and climate change adaptation, one of which is the Enhance Resilience (ER) Program. This Program aims to enable households to enhance their life skills, income earning capacity and resilience to natural disaster by creating human and physical assets (ESDO 2010).

The fifth NGO is the World Food Program (WFP) which receives financial support from the Bangladesh national government and other governments to implement projects. The *Flood Protection Beyond Dams: Building Resilience In Bangladesh* project from WFP did not create new communities for the relatively very poor that suffered from river erosion. This differs from the project *Disappearing Lands* from Practical Action, yet WFP strengthened the embankment communities by increasing their resilience to future disasters. Together with the communities they repaired and reinforced embankments, raised roads, excavated canals and ponds and elevated the ground around their houses in order to protect their communities from flooding, water-logging and increasing salinity, while boosting agricultural production.

Five key findings of this thesis are analyzed in this subsection: the high resource equity, the sense of belonging, zero learning, learning through income, and the changed practices. Moreover, an overview is provided of the outcomes and project elements on community resilience from other NGOs which the *Disappearing Lands* missed out on. At the end of this subsection a figure shows to which extent the long-term project outcomes from *Disappearing Lands* can be generalized to all the selected project outcomes in Bangladesh.

5.2.1 Resource equity

The resource equity is important to adapt to changes and create space to help other community inhabitants. As discussed, the new houses in Sreepur had initially, besides offering sufficient protection from the storm, created high resource equity. And although the differences between relative poor and rich emerged in the years following the implementation, all the inhabitants could rely on their houses as a resource.

The tube-wells and toilets are still equal accessible for all the inhabitants of the Sreepur community, although the relative rich families have a private toilet, no one has to use the open field. Other NGOs also established these facilities to fulfill the basic needs of project's participants and to create an equal access to these needs. UST installed the following:

- 4 Climat résilience public toile installation.
- 6 Climate resilient school toilet installations.
- Installation of 10 Climate resilient deep tube-wells.
- Installation of 334 Climate resilient shallow tube-wells.
- Installation of 35 rain water harvesting collectors.
- Repairing 605 existing non-functional water options.
- Repairing 25 toilets (UST saw).

The WFP arranges the same facilities on the work site during their program. Access to drinking water and sanitation at the project place where the women who are establishing their own business work. As these women also have to take care of their family and cattle, childcare and sheds were also available (WFP 2012). However, this was not implemented in their communities, only at the places where they worked, and therefore it does not contribute to the community resilience since it did not influence the resilience of the whole community.

The same goes for RDRS who encouraged and implemented raised tube-wells and latrines which remain above the water-level during flood. Besides that, the houses were raised by ground-raising. Compared to the Sreepur community, which community area has been raised, they have the same comfort of staying at home during flood as the facilities remain dry. However, they lack spaces to keep their cattle dry or staying dry while going outdoors and staying in the community. RDRS also created link roads for emergency protection purposes or for day-to-day communication. The Sreepur community has no roads only a boat to rescue people and to communicate or transport people. During the interviews in both communities, Sreepur and Malbhanga, communication and transport were problems during flood. And although the problems were more mentioned in Malbhanga the Sreepur inhabitants still face problems as they are living on an island during flood with only one boat to transport them all. Therefore a road, which is installed by RDRS, could be an opportunity to reduce the dependency on this boat (RDRS 2011; RDRS 2013). However, the distance between Sreepur and the embankment could be too big, and with a relative little amount of people using the road it would be relatively very costly. Although the boat is not a community boat anymore, which lowers the degree of community resilience, it seems to be the best option for transportation during flood.

In the Sreepur community is also an equal access to the community shed, which is a common property. No such common property is installed through any of the NGOs. However, some communities did implement some elements together which is used by the whole community and

thereby creates equality. These are flood and wind breaking measures, such as: dredging the canals for more water storage during flood and making a line of trees to break the wind (CARE Bangladesh 2006). The equal access to facilities is not recognized as important feature by CARE Bangladesh and ESDO as they do not implement it in their climate change related project.

An equal access to facilities is a common element of projects in Bangladesh, as many communities lack access to their basic needs this is one of the first implementations to improve the livelihood of poor people and to improve the community resilience. However, when income increases inequality appears again when the relative rich create private facilities.

5.2.2 Work together through a sense of belonging

The sense of belonging was strongly increased by the community buildings in Sreepur and the establishment of the volunteer group and community leader. This sense of belonging causes people to work together as they feel related to each other, and working together is crucial when it comes to protection from natural hazards and climate adaptation.

A way of creating a sense of belonging, as discussed in the theoretical framework, is by identifying your community internally and externally. Internally refers to knowing who belongs to your community and establish the location. And externally refers to telling others to which community you belong to.

RDRS, UST and WFP organized committees which discuss disaster related problems with higher policy levels, such as; district- upzilla and union committees and NGOs (RDRS 2013; UST s.a.; WFP 2012). In this structure they together improve their adaptability and responses to climate change and help implementing projects with their cash and food distributions. According to the interviews with the inhabitants of Sreepur, these kinds of groups or discussions have not been established. However, they do have an active volunteer group which consults other communities about their social and environmental issues. Although this is different from the committees established by RDRS and WFO it has similar effects; identifying your community to others and thereby creating a sense of belonging.

Identifying your community and working together is a frequent used method to create a sense of belonging by projects in Bangladesh. The *Disappearing Lands* project has a different approach then RDRS, UST, WFP and CARE Bangladesh but all of them are increasing the community resilience by enhancing the sense of a community.

5.2.3 Zero learning

The third key finding is zero learning, which are the situations in which people can start a learning process but for some reason did not learn from the situation. Zero learning can be a situation in which someone gambles that their failed action will not fail again, most of the time that person does not know how to change the situation and does not feel capable of changing it. In the Sreepur community these are the following situation: Temporary migration of the men, degrading house quality and the absent fish culture due to the structure of the pond.

However, as earlier mentioned in the previous chapter, the temporary migration of men could be culturally accepted in Bangladesh. The circumstances in urban areas, especially the living conditions,

are not preferable for Western standards. However, in Bangladesh the security of having an income is more important than the living conditions. Therefore, the temporary migration of men cannot be seen as zero learning, as it cannot be evaluated by Western standards.

The other project evaluations do not show zero learning effects. The reason for this can be that the evaluations were made by the NGO that also performed the implementation. Bias could exist in these project evaluations since they want to create a positive result to the stakeholders or other people with interest. Moreover, the projects had no objective regarding learning, and therefore the focus is not particularly on learning. However, the latter also goes for the Disappearing Lands project of Practical Action, which did have an effect on learning and showed zero learning. Another reason could be that the project evaluation was more based on the short-term outcomes. A learning process, or in this case a situation which offers the possibility to learn, could not have been observed as not much time has passed since the implementation of the project. The latter argument seems the most reasonable as no evidence of zero learning could have been found when doing a short-term project evaluation.

5.2.4 More income through learning

As discussed, an increased income has improved many lives of the people living in the Sreepur community. By increasing the efficiency of their labor, such as irrigation of their lands and buying straw in flood times for the cattle, and the effectiveness of their way of creating incomes, by shifting from agricultural day labor to leasing and owning land, they learned how to make a more profitable situation. Other projects from other NGOs also recognized the opportunity of creating more income for the project participants. CARE Bangladesh for example has got similar strategies to Practical Action, such as: (1) Increase (additional) income through alternative livelihoods, (2) increasing income through common property. Both of these strategies concern the income level of the project participants which indicates that there should be an increase in the income and income opportunities of the participants.

However, the outcome of this strategy differs. Whereas all the inhabitants of the Sreepur community have an increased income level, only 50% of the project participants of the CARE Bangladesh project have an alternative or additional income source. This can imply that they have a lesser income growth than the Sreepur community. The reason for this difference could be that CARE Bangladesh did not offer training on sandbar cropping which could change their practices and thereby provide them with a more increased income. However, CARE Bangladesh did provide training on floating garden, which is discussed later on. Although the floating garden is creating more food for the family, the amount of products is not always sufficient to also sell it to the market. This can be the reason why the participants of the CARE Bangladesh project did not all increased their income. Other factors could be that the quality of the trainings for an additional income are low or that the project participants were not inspired enough to increase their income. However, the fact that the project evaluation of CARE Bangladesh was short-term makes more sense to be the reason for not further improvements on the income level. As the project evaluation was on the short-term, it could not have evaluated the development of the improvements.

CARE Bangladesh can learn something from Practical Action, which also offered sandbar cropping as training. Another lesson could be to provide one cattle to inspire the project participants to create a new source of income.

CARE Bangladesh and RDRS have implemented creative ways of agriculture to increase the income level of their project participants, this is discussed in subsection 5.2.5.

In 2013 RDRS implemented measures to combat and adapt to climate change, which influences the degree of community resilience to climate change. However, the measures are different from those from Practical Action. The reason for this could be the fact that the project Disappearing Lands from Practical Action ended in 2009 which differs four years with the project from RDRS, and in these four years the technology was a step further. Two of those are influencing the income of agricultural workers; drought-tolerant rice cultivation and flood-tolerant rice cultivation. For extreme drought new varieties of IRRI rice are introduced (BRRI dhan57), which can survive 25-30 days of drought. Sreepur inhabitants are also using drought-tolerant rice from IRRI (IRRI boro 28), however, this was not implemented by the Disappearing Lands project. Sreepur inhabitants mentioned that the government helped them with finding drought-tolerant rice. RDRS also introduced a flood resistant rice species which could last for 15 days under water and as flash floods submerge rice field for one or two weeks 15 days is sufficient. This rice species is called BRRI dhan51 and dhan52. Although the Sreepur inhabitants have difficulties with floods and their rice cultivation they still use amon rice which does not survive floods (RDRS 2013). Again the RDRS project has more modern technology due to the fact that it was implemented in 2013. This does not take away the fact that this would be highly beneficial for the Sreepur inhabitants to know as they are still gambling on their amon rice harvest.

Although the project participants of RDRS have more success when it comes to their flood-protected rice cultivation, they did not learn from their own experience to improve their cultivation. While the Sreepur inhabitants learned by doing, for example by increasing the yield of sandbar cropping, the participants from RDRS were taught how to improve their normal yield. Although, it increased the income level of the RDRS participants and thereby their resilience to climate change, it remains uncertain if they are able to learn to improve their actions themselves. However, this was a finding was based on a short-term evaluation. It might be that in a few years the participants learn to improve this activity as well.

Another example of this is the alternate wetting and drying which was introduced by RDRS in 2013 as an agricultural measure to increase the efficiency. This irrigation method reduces water use by 30% while saving fuel and energy, by creating an irrigation indicator in the shape of a plastic tube in the ground. When the water level is below 15 cm, in the inserted plastic tube in the soil, it indicates that there should be more irrigation. This increases yields and ensures water reaches the plant only in need. While irrigation is something the Sreepur inhabitants learned to use in order to increase their yields, it again are knowledge and skills for the RDRS project participants to receive and no specific learning encouragements. However, it could be that they learned how to improve these skills by now, but no record of that has been made by RDRS (RDRS 2013).

ESDO trained their project participants on saving management. One of their case studies shows that a relatively very poor woman saves 60 taka per month. Moreover, the community savings are 600 per month, which are used for to repair group facilities. On average the savings are 1528 taka for a quarter year (ESDO 2010). ESDO inspired their project participants to save money, after their training the project participants indeed saved money. By being able to save more money the project participants improved their actions and went through single loop learning. This is similar to the Sreepur community where they learned how to save money and invest it in cattle. While the Sreepur community increased their amount of cattle which reflected the increased amount of saved money, they also went through single loop learning.

Women were the focus group of the WFP project as a whole and thereby also for the cattle breeding training. By helping women to identify activities which match their skills and their local demand they developed a business plan. WFP provided them with a cash grant as an investment and a monthly payment to support their families while they were setting up their businesses (WFP 2012). According to WFP (2012) self-employment needs to play an important role in accelerating the profit. The *Disappearing Lands* project also trained the Sreepur inhabitants on enterprises, which resulted in self-employed inhabitants who were not depended on the somewhat unpredictable agricultural income. While both projects increased the income of the project participants, the learning process of the WFP project after the implementation is absent or unknown.

Although all the analyzed projects enhance the income level of the project participants, it is not certain if the project participants learned to improve these actions by themselves and thereby go through single loop learning. Except for the saving management approach which shows learning through saving. However, learning was also not intended by the *Disappearing Lands* project, since no objective of the project was aimed at increasing the learning capability of the Sreepur inhabitants. The reason for the fact that there is less learning activity in the other projects from other NGOs could be that the project evaluations of these NGOs were more short-term focused. It could be that the project participants learned after the implementation of the project, however, these facts are not found in the evaluation of the projects.

In short, the analyzed NGOs have improved the incomes of their project participants. CARE Bangladesh did this by providing training on skills to create additional income sources and to improve the common income sources. Unfortunately, this only increased the income of 50% of the project participants. ESDO provided training on saving management, which increased their income and whereby the project participants could learn how to improve their savings by saving more every time. And WFP provided women with an additional source of income, WFP thereby not only empowered the women but also made the families less depended on unpredictable agricultural income sources.

5.2.5 Changing practices: Creative ways of agricultural work

The changing practices of the *Disappearing Lands* project of Practical Action are: Sandbar cropping and floating garden. These practices create an additional source of income and stimulate the project participants to improve themselves more, as is evaluated in the previous chapter.

CARE Bangladesh also implemented the technique of the floating garden. The technique improves the food security, and creates an additional income. The floating gardens are only used during flood and mostly for own consumption in the Sreepur community, while CARE Bangladesh goes one step further by creating a system which they call a Vegetable Marketing Group. This group has different roles in which they all contribute to making additional income besides their current job. More important these groups create a sense of community by creating attachment between people of the community and a sense of belonging as this group belongs to the particular community. Although the *Disappearing Lands* project has other elements which create a sense of community, which are not involved in the CARE Bangladesh project, this could be an additional opportunity to enhance the sense of community (CARE Bangladesh 2006).

However, in the Sreepur community there is little space in the surrounding areas to set up a floating garden system. As earlier described in the comparison with the short-term outcomes, the pond full with water could be useful in the Sreepur community. In this case the pond could function as a floating garden area besides being a place to cultivate fish. Besides the Vegetable Marketing Group there is also a Crab Marketing Group or Mele and Mat Marketing Group established after the project implementation. This implies that communal activities have strongly increased by CARE Bangladesh which increases the attachment among the community inhabitants and thereby the community resilience (CARE Bangladesh).

RDRS and Practical Action both introduced sandbar cropping and homestead gardening to the project participants. The RDRS project, in 2011, has successfully encouraged 160 households to cultivate pumpkins on sandy land and over 500 families to use vegetable plots for homestead gardening. Another resemblance is the tree planting which in both projects caused more food security and an additional income source. Moreover, the trees create more shade which is beneficial in times of extreme drought (RDRS 2011).

5.2.6 Project elements which are unique from other NGOs

The five key outcomes are chosen according to the results in the previous chapter and the categorization of this subsection. Other approaches to influence community resilience to climate change are therefore also possible. Starting with WFP, which worked together with the government to support the participants with their income and offered facilities during their skill training. The facilities offered by WFP and the government encouraged the women to participate in the project as they had nothing to lose. Moreover, this project especially empowered the women of the families by making the trainings women-only. The Disappearing Lands project did encourage women to participate in the trainings and in the volunteer group, however, women-only trainings were not provided. The focus on women is important as it could decrease their vulnerability as they become more independent while they learn how to create income.

Another approach to influence community resilience to climate change is to provide more awareness and knowledge building on climate change and disaster management. In 2011 RDRS aimed to raise the awareness through theatre in rural settings. By reenacting what could happen and what should be done, more people are talking about it and awareness and knowledge can be spread on this subject.

In 2013 RDRS enhanced the use of liming in agricultural work by encouraging an innovative farmer to share his liming idea with his neighbors and surrounding communities. Liming of the ground creates a higher yield in various crops, which creates more income and thereby making the executers of liming more resilient to climate change. The innovative farmer, named Dulal, is still supported by RDRS to experiment with different crops and to spread his word about the success of liming. Spreading this information is of high importance. And since spreading the information is done by a local person which other people can relate to people would have a higher self-efficacy to start liming as well. Moreover, the local person Dulal is experimenting by himself, the outcomes of his experiments will be very useful. As he is experimenting on the same ground and with the same tools as the target group has, probably no implementation failures will occur. This makes this system great for people whom hear about it, since the technique will not fail they will grow more confidence. This increased confidence will further increase their self-efficacy which will encourage them to learn more about this technique and experiment more themselves. The latter will create a learning process which improves the resilience to climate change. Unfortunately, the word has not spread in Sreepur about liming, which could be profitable for the inhabitants with agricultural land. The increased income is also encouraged by the Disappearing Lands project, however, this particular technique is not used.

CARE Bangladesh not only focused on the household level but also on the higher policy levels in which they promoted community resilience. This approach led to discussion on higher policy levels, such as districts and local governments, on the implementation of more measures which could be taken to increase the community resilience to climate change. While the focus of the *Disappearing Lands* project was on the community, the evaluation of the project from CARE Bangladesh shows that higher levels could also be influenced and could enhance the awareness of climate change.

These other approaches, to increase the degree of community resilience, could be opportunities for Practical Action to use in their next projects.

5.3 Conclusion on the differences and similarities of community resilience to climate change in Bangladesh

The community resilience in Bangladesh is enhanced through several approaches from projects of NGOs. Next to the approaches which are used by the Disappearing Lands project other approaches from other NGOs play also an important role in creating more community resilience to climate change. Based on this analysis, the following approaches are recommended to use in a community based climate adaptation project:

- Increasing income through learning;
- Creating a sense of belonging;
- Creating equal access to facilities;
- Empowering women to contribute to the family income;
- Using creative tools to raise awareness and knowledge building;
- Encourage discussions on higher policy levels.

These approaches above are not all in use by the NGOs which are analyzed in this chapter. The income through learning is only present in the project of ESDO which and Practical Action by focusing on saving management which they learn by doing. Practical Action also has other elements of their projects which involve learning, such as: floating garden, sand bar cropping and cattle breeding. It

could be that the other NGOs also stimulate learning and have participants that are learning to improve their income; however, the NGOs provide no or little information about this.

The sense of community is created in different ways but all the NGOs are aware of this approach to enhance the community resilience to climate change. However, creating equal access to facilities is not used in the approach of CARE Bangladesh and ESDO, which may indicate that they do not perceive this project element as an important influence of the community resilience. Another reason for not creating equal access to facilities is the lack of money to invest in such facilities or the lack of knowledge about the effect of equal access to facilities on the sense of belonging. And since this equal access to facilities, besides creating a sense of community, provides the project participants with basic needs, it should be involved in all the community-based adaptation projects in Bangladesh. No time in this thesis research was reserved to do further research on the reasoning behind the fact that other projects do not implement equal access to facilities. Therefore, this could be a good topic for future research.

6. Conclusion & Discussion

This master thesis aims to examine how community-based adaptation projects of NGOs in Bangladesh affect the long-term community resilience to climate change. A case study has been conducted to provide a detailed insight into the long-term outcomes of project activities from one of the NGOs in Bangladesh, namely Practical Action. The long-term project evaluation focused on the *Disappearing Lands* project which aimed to provide new livelihoods to the poorest people who live in the embankments. Due to river erosion, these people had to flee from their former communities to the embankments, leaving all their belongings behind. The outcomes of the long-term project evaluation were compared to the short-term outcomes in order to validate the results and to examine which project elements had already been fully implemented in the short-term period and which elements were more beneficial on a longer time period. In order to assess the wider relevance of these findings, the outcomes of this long-term project evaluation were compared to other project evaluations outcomes of community-based adaptation projects in Bangladesh.

This research aims to contribute to the understanding of the concept of resilience. It does so by combining two key concepts of resilience: community resilience and learning. Besides that, this master thesis aims to contribute to the methodology of project evaluations on community-based adaptation projects, which it does by providing new evaluation criteria about community resilience and learning. Section 6.2 explains these contributions in more detail.

This concluding chapter is divided into three sections presenting the overall conclusion, a discussion about the theoretical framework and methodology of this master thesis and recommendations for future community-based adaption projects, the evaluation of these projects and future research.

6.1 Conclusion: the answer to the research question

The research question of this master thesis is:

"In what manner and to which extent do community-based adaptation projects of NGOs in Bangladesh improve the long-term community resilience to climate change?"

The answer to this research question is divided into two parts, the first part answers the question: *In what manner do community-based adaptation projects of NGOs in Bangladesh improve the long-term community resilience to climate change?* And the second part answers the question: *To which extent do community-based adaptation projects of NGOs in Bangladesh improve the long-term community resilience to climate change?*

In what manner the projects in Bangladesh improve the long-term community resilience to climate change is explained by providing a detailed conclusion based on the findings of the case study and the other community-based adaptation project evaluations. The case study does improves the community resilience to climate change by offering trainings on skills, offering new creative techniques to cope with climate change and by offering the project participants a newly built community including housing, facilities and community buildings. The trainings on skills create new income sources and change the practices of the project participants, which are new creative techniques to cope with climate change, namely sandbar cropping and floating garden. These

changed practices are remarkable as the project participants changed the frame of sandy land and flood into profitable situations. Since the self-efficacy has been improved and the project participants have a more problem-focused coping style, the project participants are more inspired to learn how to improve themselves after the implementation of the project. The project participants go through various learning loops, as a result of this inspiration to learn. Some projects also implemented skill trainings on using creative ways to execute agriculture under the harsh circumstances of climate change. This indicates that these creative ways, sandbar cropping and floating garden, are successful as other NGOs are using these creative ways as well.

The newly built community including housing, facilities and community buildings in the case study increases the resource equity and the sense of belonging, which both increase the sense of community. Since all the project participants received the same housing, the resource equity is increased in the same way for all the community inhabitants. However, the quality of these houses degrades in the long run. The facilities installed in the community create an equal access to facilities, which is part of the resource equity. However, differences between rich and poor starts to show due to the need of privacy. The relatively rich create their own toilets as they want to have more privacy and more ownership of the facilities they use. The community buildings create a sense of belonging and resource equity, as only the community inhabitants can use these buildings. Moreover, the activities in these buildings create relationships between the community inhabitants. Other projects create a sense of community by identifying the community through setting up committees and thereby working together. The *Disappearing Lands* project only set up a volunteer committee and encouraged to appoint a community leader, which has similar effects. This effect on the sense of belonging has improved over time when the community leader and the volunteers expressed the existence of their community to outsiders when they were invited to other communities thanks to the increased trust in their knowledge and skills. Not all the other projects that were used to generalize the case study implemented a kind of resource equity. Only one other project implemented facilities, another only offered the facilities during the project and yet another encouraged to improve the community facilities. However, some projects did not focus on creating facilities at all.

In sum, the community-based adaptation projects of NGOs in Bangladesh improve the long-term community resilience to climate change by improving the skills of the project participants and changing their practices to adapt to climate change. This increases the income of the project participants, which makes them more resilient to climate change. The community resilience is increased by setting up committees and, in doing so, creating a sense of belonging. This sense of belonging increases the sense of community, which increases the willingness to help each other in the community in times of need, which can include enduring effects of climate change.

To which extent the community-based adaptation projects from NGOs in Bangladesh improve the long-term community resilience to climate change is explained by describing which elements of the project had a positive or negative effect on the community resilience to climate change. The case study shows a clear effect on the long-term community resilience to climate change. The four key findings are the high resource equity, the sense of belonging, zero learning, learning through income, and the changed practices. The high resource equity and the sense of belonging were sufficiently applied by the *Disappearing Lands* project. Besides that, it influenced the learning through income of

the project participants, as the skill training did not only improve the resource equity, because it also encouraged the project participants to improve their skills by learning. Other project evaluations show significantly less results on learning. This could be because there was no increase of learning among the project participants, or because the project evaluation was executed within a short time period which could not have revealed any learning processes after the project implementation. The sense of belonging, which was partly created through the establishment of a volunteer committee and appointing a community leader, was successful in many ways. This project element was also used by some other projects, although these communities implemented more committees, which improved the community resilience even more.

However, the *Disappearing Lands* project also influenced the community resilience negatively as zero learning processes are still present among the project participants. The *Disappearing Lands* project failed in creating a pond that could have enabled the community inhabitants to start use fish caging. Other projects do not show this kind of zero learning processes, as they made their project evaluations on the short term and mostly used these evaluations to promote themselves in a positive way.

To conclude, providing skill training, housing, community buildings and facilities and setting up committees positively influence the community resilience to climate change in Bangladesh. However, incorrect implementation or incomplete skill trainings can cause zero learning processes that negatively influence the community resilience to climate change in Bangladesh.

6.2 Discussion

This master thesis is based on a unique theoretical framework and a combination of methods which contribute to the understanding of the resilience theory and the methodology of project evaluations. Moreover, this master thesis uses a long-term project evaluation which is unique among the project evaluations of NGOs in Bangladesh.

The theoretical framework is unique in combining two key concepts of resilience, namely community resilience and learning. The application of these two elements in one framework showed that there can be interaction between the two types of elements in the framework. The coping style and self-efficacy, both components of community resilience, increase the number and degree of the learning processes. It showed that when someone improves its action, and then goes through single loop learning, this person has a high self-efficacy that creates the feeling that he or she is capable of changing his or her actions. For example, in the case study the self-efficacy was low considering the change of the amon rice production which failed as the community inhabitants did not believe they were able to change this situation. However, the self-efficacy was high after learning sandbar cropping, which made them believe they could influence the situation. This improved the action and thanks to this, they went through single loop learning.

The same goes for the coping style. When someone improved its action and thus learned to deal with the problem, this person focused on the problem instead of on his emotions. This problem-focused coping style enables a person to learn to cope with the problem rather than feel miserable and hopeless, which is an emotion-focused coping style. This interaction between community resilience and learning confirms that learning makes up for a great part of community resilience. Moreover,

this interaction shows that the combination of these two components can create a better understanding of how to build community resilience.

However, some difficulties in theoretical framework made it hard to execute the project evaluation. The abstraction of the resilience concept caused barriers to operationalize the theory since the resilience definition can be interpreted in multiple ways. Moreover, other resilience definitions did not help to make the theoretical framework less abstract. Therefore, I chose to focus on learning within resilience. The learning loops were a great tool to execute a project evaluation. However, the differences between double loop learning and triple loop learning remained vague. I tried to solve this by adding more specific characteristics to the learning loops, which created a clearer framework. More research on the learning loops is needed to make the framework clearer and to create a more clear difference between double and triple loop learning. Since I experienced the learning loops as a useful tool for doing a project evaluation, future research on these loops can create additional value for these loops regarding project evaluations.

The case study method used in this master thesis provides new insights, as it analyzes the long-term implementation effects of community-based adaptation projects. Although the long-term effects provide valuable insights, it seemed that there were no other long-term project evaluations available when I tried to make a generalization. In my opinion, NGOs in Bangladesh are missing out on valuable information which they can only retrieve from a long-term project evaluation. This master thesis reveals that the long-term effects were different from the short-term effects of the case study, in that the long-term effects provided greater insights into the sustainability of the project implementations.

Reasons for the absence of long-term project evaluations are multiple. It could be that the NGOs in Bangladesh are not aware of the valuable knowledge they can gain through a long-term project evaluation. Another reason can be that the NGOs are aware of the value of the long-term project evaluation, but do not have the resources to execute this kind of evaluation. This is the reason for Practical Action to only do a long-term project evaluation once a year, which they call a 'looking back study'. Whether one project evaluation a year is enough or not, is hard to tell. However, Practical Action has many projects in different development fields that can all benefit from a long-term project evaluation. Doing a long-term project evaluation once a year seems to be insufficient to cover all their projects.

The funds, which make these projects possible, also influence the execution of a long-term project. Possibly, the funds are only interested in the short-term outcomes and therefore only provide money for short-term project evaluations. Related to that, results of a long-term evaluation could show implementation errors, which provide negative promotion for the NGO. In that perspective, it could be that these long-term evaluation are indeed executed, yet only used for internal improvement of organizations. A final possible reason could be that the NGOs in Bangladesh are constantly implementing projects and do not have the time or the manpower to execute a long-term project evaluation.

Besides the difficulties in gathering long-term project evaluations for the generalization of the case study, the classification of the term long-term is a point of discussion. In this master thesis the term

long-term is used for a time period of five years after implementation. However, according to King and Behrman (2009), this can still be seen as a short-term project evaluation, since projects that concern the change of behavior can still fail in showing the impact. The change of behavior in the case study, which is used in this master thesis, is that the project participants needed to change their lifestyle to become more resilient to climate change. The timing to evaluate this kind of project is an important issue which is understudied according to King and Behrman (2008). Projects can differ in their way of creating an impact. For example, one project can increase the skills of project participants which will improve their income. This improvement will accelerate if the project participants start to learn how to improve the skill. The project impact is then similar to the figure in the top of figure 16. On the other hand, when the other project provides a resource for the project participant, it creates an unmediated impact on the project participant, which is shown in the bottom figure of figure 16. The timing of the project evaluation is preferably linked to the impact of the project. In figure 16 the difference in program impact considering the timing of a project evaluation is shown, with different evaluation timing. The timing of t1 is short-term, the timing of t3 is long term and the timing of t2 is somewhere in between.

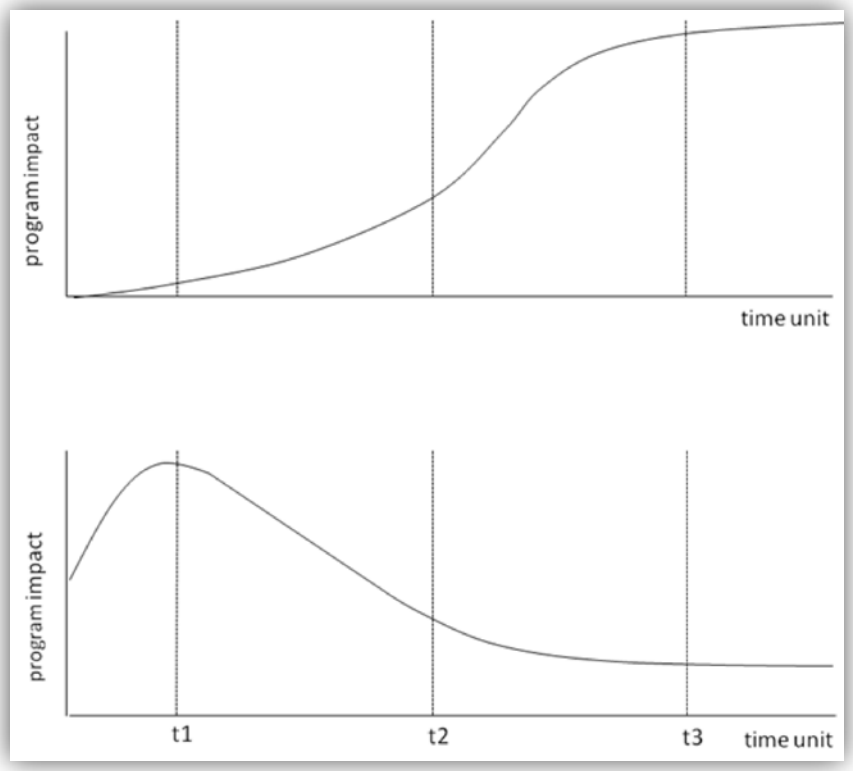

Figure 16: Timing of impact of project or program evaluation and its impacts.

The project, *Disappearing Lands,* from Practical Action had both kind of impacts, short-term impacts and long-term impacts. Since the project provided housing, it creates a short-term impact, and because of the skill trainings it creates a long-term impact. Therefore, doing a project evaluation somewhere in between, in figure 16 this is referred to as t2, is preferable. Whether five years after the project implementation can be seen as somewhere in between two peaks of impact is hard to decide. However, the long-term project evaluation showed some implementation gaps and therefore, it can be concluded that it succeeded to evaluate the long-term effects of the project.

The latter is one of the recommendations for other NGOs on how to execute their project evaluation. Other recommendations are discussed below in the recommendation subsection.

6.3 Recommendations

Four recommendations can be made after writing this master thesis and thereby executing a long-term project evaluation in Bangladesh. The first recommendation is on the content of the community-based projects in Bangladesh. Not all the projects, which were used for the generalization of the case study, showed the implementations which are positively influencing the community resilience to climate change. For example, creating access to facilities, and thereby increasing the resource equity, is not used in the approach of CARE Bangladesh and ESDO. This could indicate that they do not perceive this project element as an important influence on the community resilience. Another reason for not creating access to facilities is the lack of money to invest in such facilities or the lack of knowledge about the effect of equal access to facilities on the sense of belonging. However, access to facilities has made a great impact on the community resilience in the case study. And since this access to facilities, besides creating a sense of community, provides the project participants with basic needs, it should be involved in all the community-based adaptation projects in Bangladesh. It would be interesting to know why these NGOs did not invest into facilities, and therefore this could be a good topic for future research.

The second kind of recommendation is on the manner project evaluations are executed. As earlier mentioned in the discussion section, project evaluation should have a right timing. Since the impact of the project could be short term or long term, the timing of the project evaluation could show misleading effects of the project.

The project evaluation in this master thesis had a reasonable timing, however, it was executed in a relatively short time period with little background knowledge on the culture of Bangladesh. The short time period is refers to the time period of seven months in which this project evaluation is executed. Although this seems like a reasonable time to spend on a project evaluation, the fact that it was executed by only me while I was not well known with the culture makes the seven months seem like a quite short time period to execute a project evaluation. I tried to cope with these limitations through several ways. By living with a Bangladeshi family and constantly surrounding myself with people from Bangladesh, I quickly learned some basic cultural aspects of Bangladesh. Besides that, I asked the local staff of Practical Action many questions about the culture of Bangladesh. And after I did my fieldwork I spend some time in Bangladesh which made me aware of the living standards in Bangladesh. The short time period could not have been prevented, although I spend more time in Bangladesh and on my thesis than planned, I would still prefer a longer time period to do a my master thesis for the sake of the quality of the project. Therefore, it could be interesting to execute a project evaluation on this topic with more persons executing it and a longer time period available to enhance the quality.

The third kind of recommendation is about sharing knowledge between the NGOs in Bangladesh. To learn more about executing a long-term project evaluation it could be interesting to see NGOs working together to improve their method on doing a project evaluation. Moreover, this could improve the content of community-based project evaluations as the long-term project evaluation

show which project implementation has which kind of impact. Sharing this knowledge can be achieved by setting of a platform for NGOs in Bangladesh to share their long-term project evaluations. NGOs could be afraid of losing their great ideas and unique methodology to other NGOs in Bangladesh. However, all the NGOs have different objectives, values and target groups which make the NGO unique despite their similarities in methods and new ideas. Hopefully this can be applied in the near future, to improve the quality of both the project and the project evaluations.

The final recommendation I want to make is on how to increase the learning capacity among community inhabitants in Bangladesh. I discovered that learning can have a great impact on the lives of the community inhabitants. More research is needed to examine how learning can be triggered and which project elements make the difference between single loop learning, double loop learning and triple loop learning. Moreover, the differences between double loop learning and triple loop learning remain vague, as described above. More theory about these loops can create more clarity. Adding on to that, more shared experiences with applying these learning loops could make the learning loops less abstract.

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Annex

Annex 1: Interviews Sreepur

Interview 1

Gender	**Male**		
Age	55		
Household head	Yes		
Number of people in household	10		
Amount of people whom create income	3 1 son Brickfield Dhaka 1 son day labor		
Education	Only signature		
Source of income	**First income** Small trade	**Second income** Agriculture	**Third income** Son 1 Brickfield Dhaka Son 2 day labor
Income	150 per day	32500 corn in a year 37500 jute in a year	
Savings	175000 in 3 years (he bought land from this)		
Assets	2 goats 3 cows		
Loans	No		
Contribution to ceremony	2 times a year 400		
Role in the community	Wise man Community Leader		

Situation before affected by river erosion

He was living actually close to the place where his jute field is now, not so far from the community. He lived in a straw made house and was the only one with income for a 5 person family. He job was

to have small trade in flower. He bought flower from the factory and sold it on the market. His family could live from this income but he had no savings.

Observed climate change situation

Floods

Two months a year he has trouble with floods, during this time he uses his own boat to help people and to transport goods. The flood has influence on his agricultural land, it gets sandier.

Droughts

Due to droughts he has problems with his jute production, he has to irrigate more and this is more costly.

River erosion

He has been replaced 3 times by river erosion, he got separated from his brother. He is unhappy with this separation but he is happy to be with the rest of his family, his two sons.

Tornadoes

Project memory

As a wise man he cooperated with Akota to implement the project. He became the community leader and was active in many trainings; trainings cattle rearing, training vegetable cultivation, training leadership, sandbar cropping (pumpkin).

Project information

Short-term outcomes

Housing

Before the project he had a house made of straw and now he has a house made of brick, which is better prepared for storms.

Income

Huge increase compared to his income level in his previous community. He was first selling flower as a small trade; from factory to market place. He sometimes did agricultural day labor. After the project he started doing share cropping and sandbar cropping. He thereby changed the things he did for living which is increasing his effectiveness.

Social connections

He was giving lectures and trainings to other communities about agriculture and therefore increased his social connection tremendously

Health

His health is increased through income and not specifically through the project. This is an indirect change.

Infrastructure

The facilities are good and when things get broken they repair it themselves or somebody repairs it for them.

Long-term outcomes

Housing

His house sometimes gets broken, his ‘curtain’ for his window is now partly replaced by plastic to prevent his house from having holes in it. However it does not function the same way as the bamboo curtain did, light and wind can come through. He did this by himself but is not solving any problem except for repairing the hole in his house.

Income

His income is still increasing because people trust him more after the project. He now owns land due to his savings skills from the project. On this land he has people working for him as agriculture day labor. He also hires people and machinery to irrigate his land. He has more assets and less labor for himself. He is happy to provide work for the relatively very poor and thinks he is a good boss as he can relate to their situation. By changing his role in agriculture from share cropping to having own land he increased his efficiency while using his skills and knowledge from the project and the community.

Other information

Intervening criteria

No

Interview 2

Gender	**Male**		
Age	27		
Household head	Yes		
Number of people in household	5		
Amount of people whom create income	1		
Education	No		
Source of income	**First income** Small trade ice cream	**Second income** Shopkeeper (his wife assists)	**Third income** Agriculture
Income	250 per day	75 per day	14500 jute yearly 10000 corn yearly
Savings	Invest in cattle		

Assets	1 cow 1 chicken 1 box
Loans	No
Contribution to ceremony	2 x 750 taka
Role in the community	Shopkeeper Volunteer

Situation before affected by river erosion

He was living in a straw made house and was doing agricultural day labor.

Observed climate change situation

Floods

He has problems with his jute production during flood. Also he finds it hard to move to other places during flood since Sreepur is an island during flood.

Droughts

Due to droughts he has problems with plowing, he has to irrigate before he can plow.

River erosion

He is two times displaced and separated from his brother.

Project memory

He is very satisfied with the project as he got a new house and a sheep. He received trainings on: Small trade, food processing and sheep rearing (wife).

Project information

Short-term outcomes

Housing

First he had a straw made house now he has a house made of brick.

Income

Right after the project his income improved slightly. He started to do small trade in ice-cream after getting training from the project. This changed his whole income system from being in agricultural day labor to being in charge of his own income by doing small trade.

Long-term outcomes

Income

With his knowledge from agricultural day labor he started share cropping in 2012. He was able to do this besides his small trade and increased his income. He therefore increased his effectiveness.

Other information

Intervening criteria

Department of affected erosion was a partner of practical action while giving agricultural trainings.

Interview 3

Gender	**Female**		
Age	25		
Household head	No		
Number of people in household	4		
Amount of people whom create income	1		
Education	Only signature		
Source of income	**First income** Rickshaw (Husband)	**Second income** Brickfield (Husband) Dhaka	**Third income**
Income	250 per day	6.000 a month	
Savings	To buy cattle		
Assets	2 cows 4 goats 15 chicken		
Loans	No		
Contribution to ceremony	3 x 700 taka		
Role in the community	No		

Situation before affected by river erosion

Observed climate change situation

Floods

During floods she has trouble with moving her cattle, this gives problems when feeding the cattle.

Droughts

During droughts there is no sufficient amount of grass to feed her cattle.

River erosion

She is displaced once.

Project memory

She was very happy when she was part of the project, she received a house and she got poultry training.

Project information

Short-term outcomes

Housing

This was a big improvement for her.

Income

She started having cattle due to the poultry training, this changed her situation tremendously. Now she can save money and is less vulnerable.

Long-term outcomes

Income

Now she has more cattle and learned from the community how to feed them during flood, by buying straw from the market.

Other information

Worth of cattle

Cow	20.000	taka
Goat	2.500	taka

Chicken 50 taka

Intervening criteria

No.

Interview 4

Gender	Male		
Age	32		
Household head	Yes		
Number of people in household	3		
Amount of people whom create income	1		
Education	No		
Source of income	First income	Second income	Third income

	Fishing / business	Agriculture day labor	Sweet shop (wife assists)
Income	300 per day for 5 months	300 daily for 5 months	400 daily for 2 months
Savings	6.000 taka in 5 year		
Assets	6 chicken		
Loans	No		
Contribution to ceremony	3 x 400 taka		
Role in the community	None		

Situation before affected by river erosion

Observed climate change situation

Floods

He benefits from the flood as he can earn more money when there are more floods or when the flood holds on longer.

Project memory

They received a house and his wife got training, including fish caging training.

Project information

Short-term outcomes

Housing

First he got a straw made house and now he got a brick made house.

Long-term outcomes

Income

Together with the knowledge of his wife they made a bigger fishing net so they can catch more fish.

Other information

Intervening criteria

No.

Interview 5

Gender	Female		
Age	37		
Household head	Together with husband		
Number of people in household	3		
Amount of people whom create income	1		
Education	Only signature		
Source of income	First income Agriculture day labor	Second income Cow rearing	Third income
Income	135 taka for 6 months		
Savings	No		
Assets	2 shared cows		
Loans	35.000 taka for health problems of husband		
Contribution to ceremony	2 x 150 taka		
Role in the community	No		

Situation before affected by river erosion

They were living in a straw made house and were both working in agricultural day labor.

Observed climate change situation

Floods

When there is flood they have less agricultural work.

Project memory

She got a house and training on: Fish training, cage training, vegetable training, sheep/goat/cattle rearing.

Project information

Short-term outcomes

Housing

She got a brick made house.

Income

They started share cropping, cow rearing and their own vegetable garden. This was done with knowledge of the trainings and implies a change of their income system by multiplying their income sources and saving money.

Long-term outcomes

Income

Due to illness of her husband he had to stop working, therefore they stopped share cropping. This resulted in less income and therefore they are now sharing 2 cows instead of having them. They needed to loan money for his treatment and now only the wife can work and she is back in working in agricultural day labor. They had huge positive short-term results on their live from the project, but they were not able to cope with health related problems. This implies a decrease in their

effectiveness, as they have still different sources of income but not enough to be able to save money and they had to return to their depending income agriculture day labor.

Other information

Intervening criteria

No.

Interview 6

Gender	**Female**		
Age	20		
Household head	No		
Number of people in household	8		
Amount of people whom create income	3		
Education	High school class 9		
Source of income	**First income** Rear cattle chicken sheep and goat	**Second income**	**Third income**
Income			
Savings			
Assets	2 cows 1 goat 3 sheep 5 chicken		
Loans	No		
Contribution to ceremony	4-5 x 400 taka		
Role in the community	No		

Situation before affected by river erosion

She was married after project implementation, so no participation in the project. She lived in the embankment with her family nearby Sreepur.

Observed climate change situation

Floods

Feeding her cattle.

Project memory

She was married after project implementation, so no participation in the project.

Interview 7

Gender	Male		
Age	24		
Household head	No		
Number of people in household	8		
Amount of people whom create income	3		
Education	High school class 8		
Source of income	First income Agriculture share cropping	Second income Agriculture day labor	Third income
Income	Jute and corn 28.000 taka a year	10 months 200 taka	
Savings	10.000 taka insurance company over the last 8 years (he will receive interest)		
Assets	2 cows 1 goat		

	3 sheep 5 chicken
Loans	No
Contribution to ceremony	4-5 x 400 taka
Role in the community	Volunteer during floods (learnt it from his family)

Situation before affected by river erosion

He was too young to work, during his time in the embankment he was a rickshaw puller and did agriculture day labor.

Observed climate change situation

He needs to irrigate his land more and more, but it is not too expensive for him.

Project memory

His mother participated in sandbar cropping, vegetable training, sheep and poultry training. He learned this skills from his mother, now is able to cultivate his share cropping land.

Short-term outcomes

He is now able to save money from the money he earns as a share cropper, he invests this money so he can earn more money and save it for later. He is also leasing land, people trust him more since he lives close to the land he cultivates.

Long-term outcomes

He now cultivates his share cropping land nearby the community which makes it easier to cultivate and the distance is for him very beneficial. The geographical location of the community is an advantage for him, the training and the replacement are elements that contributed to this.

He got married and built an extra house for him and his wife, so he can live close to his parents and has a private house for his new family.

Other information

Intervening criteria

His wife is from outside the community.

Interview 8

Gender	**Female**		
Age	33		
Household head	No		
Number of people in household	3		
Amount of people whom create income	2		
Education	Primary school class 4		
Source of income	**First income** Agricultural day labor (Husband)	**Second income** Share cropping (Husband and Wife)	**Third income**
Income	6.000 per month for 6 months	16000 corn yearly 11250 jute yearly	
Savings	18.000 invested in cow		
Assets	2 cows 2goats 13 ducks 4 chicken		
Loans	No		
Contribution to ceremony	4-5 x 700 taka		
Role in the community	Volunteer		

Situation before affected by river erosion

She was living in no good circumstances; no sufficient facilitation and she had to go to the shelter every year for 2 months.

Observed climate change situation

Droughts

Feeding cattle.

Project memory

She got a house of bricks and received training on: Poultry, cow, sheep rearing, and vegetable training. Her husband received information from her.

Project information

Short-term outcomes

She and her family are replaced and received a better house, first she lived in a straw house now she live in a brick house. Her livelihood is improved as she has better sanitation facilities as toilets and latrines, this improved her health. She now has access to one of the ten tube-wells.

During flood she used to go for two months to another place for shelter without having any income. Now she can stay where she is and her husband is working in agricultural day labor at another place where there is no place, he uses boat as his transport.

Housing

Better house and during flood she had to shelter for two months each year without working. This improved her effectiveness.

Income

They now work somewhere else.

Health

First they had no tube-well, sanitation and toilets. Now they have and it improved her health.

Long-term outcomes

Now people trust her and her husband to engage with share cropping.

Housing

They made shelter around the house to create room for cooking and duck rearing. They are using their house in a more effective way.

Income

They are now irrigating their land to produce jute during drought with the knowledge of somebody of the community which learned it from the project. This is improving their efficiency.

She uses her knowledge about vegetable training on her own little vegetable garden around her house and for share cropping. By having their vegetable garden they improved their effectiveness of their income.

Other information

Intervening criteria

No.

Interview 9

Gender	Female		
Age	43		
Household head	No		
Number of people in household	6		
Amount of people whom create income	3		
Education	No		
Source of income	First income Own land	Second income Share cropping	Third income Son 1: Horse car driver Son 2: Shallow engine machine
Income			
Savings			

Assets	5 cows 2 sheep 10 small ducks 7 chicken 45 small chickens
Loans	No
Contribution to ceremony	11 x 650 taka
Role in the community	She: Leader in community He: Leader in community and surrounding communities: Solving fights in other communities

Situation before affected by river erosion

First they were living in a flood prone area and her husband was doing agricultural day labor and temporary migrated to Dhaka to work as a rickshaw puller.

Three times replaced by river erosion, then they were placed in embankment and now they are living here.

Observed climate change situation

Project memory

She got training in: Rearing cow, sheep, poultry, vegetable. He got training in: Leadership, floating garden (they do it in the river canal), sandbar training.

Project information

Short-term outcomes

During flood she is creating little income and food for her by using floating gardens in river canal. They know it from the project.

Housing

Income

They changed from depending on agricultural day labor to doing share cropping and having own land.

Social connections

No temporary migration of her husband to Dhaka.

Long-term outcomes

The last two years there was not sufficient flood and therefore they are not doing the floating garden anymore they now focus more on jute production and on their garden around their houses. They reacted on the changing climate by changing their activity which is now more effective.

Income

The family made the horse car from the knowledge of an inhabitant of the community and repairs are made by themselves and they learned it from the community (the grandfather of someone in the community) and by observing the problem.

The other son is shallow engine driver (irrigation machine), he learned it to first become an assistant and now he knows how to do it. Their son is spreading information about this in the community.

Other information

Intervening criteria

No.

Interview 10

-No picture available-

Gender	**Female**		
Age	18		
Household head	No		
Number of people in household	3		
Amount of people whom create income	1		
Education	High school class 6		
Source of income	**First income** Carpenter (Husband)	**Second income** Day labor (Husband)	**Third income** Share cropping (Husband and wife together)
Income	400 per day for 10 months	400 per day when he is no carpenter	Jute: 5.000 a year Corn: 3.000 a year
Savings			
Assets	1 cow		
Loans			
Contribution to ceremony	4 x 500 taka		
Role in the community			

Situation before affected by river erosion

Her husband was an assistant in carpeting and was not involved in any other job before the project, also no activities as cattle rearing and share cropping.

Her husband was living in a small house made of straw which was not good for her health.

Observed climate change situation

Floods

During flood her husband needs to do his job in another place. They feel isolated during flood and have communication problems, they transfer themselves by the boat of the community leader.

Project memory

Her grandmother received training in: cow, poultry rearing, vegetable, fish cage, agriculture.

Project information

Short-term outcomes

Her husband learned to be a carpenter by first being an assistant (then he only received food) and now he can do it by himself.

Her husband lived here from the start of the project and she married him and moved in his family house, originally her family is from another place.

Income

She learned how to fatten the cow by receiving knowledge from community members, which in their turn learned it from the project. This is a change in their system as they can now invest their money.

She and her husband learned from the community/grandmother how to do agricultural work.

She and her husband also hire people on their share cropping land.

Long-term outcomes

Other information

Intervening criteria

She got training on agriculture from other NGOs. She uses it for her house garden.

She is spreading this information to a few community members.

Interview 11

Gender	**Female**		
Age	42		
Household head	No		
Number of people in household	4		
Amount of people whom create income	2 (child partly)		
Education	No		
Source of income	**First income** Day labor in Chittagong: digging/agricultural	**Second income** Son: Agriculture day labor	**Third income** She: Mortgage land and sandbar cropping
Income	300 taka per day for 10 months		Rice: 26.500 a year
Savings			
Assets	1 cow 10 chicken		
Loans	No		
Contribution to ceremony	4 x 700 taka		
Role in the	Volunteer		

community

Situation before affected by river erosion

Husband was only doing agriculture day labor.

Observed climate change situation

Floods

Her rice failed last year, she is now also cultivating rice in another season: Irri-borro rice.

Droughts

It affects her vegetable garden around her house.

Project memory

She got training in: Sheep rearing, vegetable training, handicraft training, basket training.

Project information

Short-term outcomes

Housing

Income

Start vegetable garden around her house, for own production and sells a little bit. This changed her system of income.

Social connections

Health

Infrastructure

Long-term outcomes

She is not doing basket making/handicraft because she has no raw material, first she did it but now not anymore.

This year it is too hot so she cannot do a vegetable garden around her house. She now buys it from the market.

Income

They started to also have mostert besides having rice and jute, which increased the effectiveness of their land.

Other information

Intervening criteria

Change of rice type from goetoshona to boro 28, they got this information from the government IRRIBORO.

Interview 12

-No picture available-

Gender	Female
Age	42
Household head	No
Number of people in household	5
Amount of people whom create income	3
Education	No

Source of income	First income	Second income	Third income
	Brickfield Dhaka (Husband)	Rickshaw Dhaka (Husband)	Son: Factory work Dhaka She: Mortgage land, share cropping, sandbar cropping
Income	300 per day for 7 months	350 per day for 3 months	4.000 per month for 12 months Rice: 16.000 yearly (irriboro 28 rice) Jute: 5.000 yearly
Savings	No		
Assets	1 cow 4 goats 3 chicken		
Loans	No		
Contribution to ceremony	4-5 x 500 taka		
Role in the community	Volunteer		

Situation before affected by river erosion

Husband has a job as Brickfield worker and rickshaw puller.
She had no land and no cattle.

Observed climate change situation

Floods

Sometimes lose crops
20% of rice is lost because of drought and because of sand which is now on the land due to flood, this sand cannot keep water.

Droughts

20 little chickens that died due to the heat (chicken pox)→now she keeps animal in shadow and gives water.
In combination with sand from the floods she loses crops and jute production.

Project memory

Training in: sheep rearing, vegetable, sandbar cropping, cage fish.

Project information

Short-term outcomes

Income

She learns how to do cage fishing, and uses it.
She learned how to rear cattle, grow vegetable and use the sandbar.

Long-term outcomes

Income

Became a volunteer of the community, she learned it from the community, which learned it from the project.
She has now problems with the land because due to the drought

Other information

Intervening criteria

No.

Annex 2: Interviews Malbhanga

Interview 1

Gender	**Male**		
Age	28		
Household head	yes		
Number of people in household	3		
Amount of people whom create income	1		
Education	High school Class 7		
Source of income	**First income** Shallow engine machine	**Second income** Agriculture own land	**Third income** Agriculture own land
Amount of income	14.000 in a year	Rice: 13.000 in a year	200 per day for 3 months
Savings	No		
Assets	No		
Loans	No		
Contribution to ceremony	3-4 x 300 taka		
Role in the community	Volunteer for flood protection; he helped building the bridge.		

Basic information

He lives in a house made of iron which is capable to handle small storms, but with big storms he has to repair his house. During flood sometimes his house gets broken but he repairs it himself.

Observed climate change situation

Floods

Problems occur with communication and transportation. He has no income during flood. In 2013 he lost his crops during flood, now he is hoping it does not happen again but he is not changing anything.

Droughts

He has to irrigate the land of others more but does not get more money for it, therefore he works harder during drought.

Learning capability

Income

He learned how to become a shallow engine driver from somebody outside the community. He was first an assistant and now he can do it by himself. This increased the effectiveness of his income as he is self-employed.

He learned how to cultivate his own land from the community and his parents. This changed the effectiveness of his income.

Housing

Due to a higher income he replaced his straw made house for a house made of metal, which is more capable of withstanding storms and floods. This increased the effectiveness of his house.

Other information

Intervening criteria

No.

Interview 2

Gender	Male		
Age	52		
Household head	Yes		
Number of people in household	5		
Amount of people whom create income	2		
Education	No		
Source of income	First income	Second income	Third income
	Agricultural day labor	Own land	Son: Garments Dhaka

Amount of income	3.000 per months Own consumption
Savings	Saved money for married daughters
Assets	1 cow 1 goat
Loans	10.000 consumption during flood
Contribution to ceremony	5-6 x 250 taka
Role in the community	Community leader

Basic information

Son got training in the garments factory as being an assistant. He works 8 months, 4 months he is at home (factory is closed).

Normally he has no problems with his house during floods.

He is not changing his plants considering jute production; he hopes the drought will be less.

He bought his cow by saving the income from his son.

Observed climate change situation

Floods

Communication and transportation problem. No income during flood. Cows are hard to feed, he feeds them less and bad by feeding them banana three leaves or straw. They loan money from others.

He has little food during flood and therefore he sometimes eats less food: instead of 3 meals 2/1 meal. Sometimes he loans money from others to feed himself and his family

Droughts

Jute production, it damages. No irrigation facilities and his land is sandy so water does not solve the problem. Maybe in the future he will install a shallow engine.

Land has no connection to groundwater so he cannot install a shallow engine machine.

Learning capability

Income

He learned to have his own land with the knowledge of his parents.

Housing

Sometimes during flood he can stay in his house by making wooden steps to keep dry feet.

Other information

Intervening criteria

No.

Interview 3

Gender	**Male**		
Age	40-45		
Household head	Yes		
Number of people in household	6		
Amount of people whom create income	2		
Education	No.		
Source of income	**First income** Small trade chicken	**Second income** Own land	**Third income** Son: Garment Dhaka
Amount of income	400 per day for 3 days in a week	Jute: 31.000 yearly Weed: 9.000 yearly No rice last year	
Savings	No		
Assets	2 cows		
Loans	12.000 cultivation costs; fertilizer, irrigation		
Contribution to ceremony	6-7 x 400 taka		
Role in the community	Volunteer with repairing houses after storm or flood.		

Basic information

He now uses amon-rice and irriboro rice, last year the amon-rice was vanished by the flood, during the other (dry) season he uses irriboro-rice. For flood season he again uses amon-rice, hoping the flood will not come so quickly this year. Irri-borro rice is in dry season: November – March. Amon-rice: March – October.

He has a "normal" house made of metal.

He sometimes gives his land away as mortgage land when he needs money and when he cannot use his land.

Observed climate change situation

Floods

Range of chicken selling, he sells it house by house, during flood he cannot sell it to so many houses, his delivery range is then smaller.
Trouble with transportation.
He has no sanitation during flood, normally he has a homemade toilet (which 50% of the community members have).

Droughts

Jute was damaged and he had no money to use sufficient enough irrigation.

Learning capability

Income

He gives away his land when he cannot use it to increase his effectiveness of his income.

Other information

Intervening criteria

No.

Interview 4

Gender	**Female**		
Age	45		
Household head	Yes		
Number of people in household	1		
Amount of people whom create income	0		
Education	No.		
Source of income	**First income** Begging	**Second income** Made/servant	**Third income**
Amount of income	55 taka per day for 7 months	55 taka per day for 1 month	
Savings	1200		
Assets	No		
Loans	No		
Contribution to ceremony	2 x 100 taka		

Role in the community	She has a paralyzed man so she and her family are not a contributing part of the community.

Basic information

Her husband got a stroke a year ago, before he was working in the Brickfield and now his income is gone. She now earns money by begging and nearly survives.

When he got a stroke he got no help only some extra rice to feed him. He is in need of a wheelchair and better healthcare to overcome his stroke.

Her house is made of two tin-houses "Bangla-houses". Tin does not need repairing so often as straw and is therefore cheaper. She repairs her own house but this is not sufficient.

Observed climate change situation

Flood

She has no income because of moving problem, no transportation and she has no communication.

Drought

Too hot to work so she has no income.

Intervening criteria

No.

Interview 5

Gender	**Female**		
Age	36		
Household head	No		
Number of people in household	4		
Amount of people whom create income	1		
Education	Primary school class 3		
Source of income	**First income** Own land (got it from parents)	**Second income** Agricultural day labor (Husband)	**Third income**
Amount of income	Rice: 8.000 yearly (amon/irriboro)	250 per day for 6 months	

Savings	No
Assets	2 chickens (gift from sister)
Loans	10.000 for consumption during flood and drought (when there is no income)
Contribution to ceremony	1-2 x 200 taka
Role in the community	No.

Basic information

She lives in a Bangla-house, jute stick walls and tin roof. Her chicken sometimes get sick and then she feeds them medicine from the doctor in nearby town, however, this often does not solve the problem.

Last five years she went 3 times to the shelter during flood. After the flood comes they go on a raft with all their belongings: Clothing, chickens, family, food, sometimes cattle, cooking materials.

Water can destroy her house and then she repairs it herself or sometimes they hire some person to make it. The flood damages the house by rotten the pillars and walls.

Observed climate change situation

Flood

Communication and food problem.

Drought

Not sufficient irrigation water, because the water level is too low which they cannot reach and this makes its too expensive. They get some water but not enough.

Disease of the chicken, she keeps it in a chicken shed but this does not help. She gives the chicken medicine but does not go to the hospital, that's too far away.

Learning capability

Income

Learned how to cultivate her own land from her parents and community, thereby she increased the effectiveness of her income.

Other information

Intervening criteria

During flood she sometimes gets food for 7 days which is 10 kg of rice. This comes from VGD.

Interview 6

Gender	**Female**		
Age	35		
Household head	No		
Number of people in household	6		
Amount of people whom create income	2		
Education	Only signature		
Source of income	**First income** Carpenter (Husband)	**Second income** Son: Garments Dhaka	**Third income**
Amount of income	250 per day for a whole year	2.500 per month for 6 months	
Savings	No		
Assets	2 chickens		
Loans	21.000 for food during flood		
Contribution to ceremony	No		
Role in the community	No		

Basic information

She goes to shelter or relatives during flood.

Observed climate change situation

Flood

Her house breaks a little bit on the platform.

Drought

Cold and hot weather killed 7 of her chickens

Learning capability

Housing

When her house breaks during flood or storms she repairs it herself, which is not making her house better. She uses the knowledge of the community members.

Other information

Intervening criteria

No.

Interview 7

Gender	**Male**		
Age	32		
Household head	Yes		
Number of people in household	4		
Amount of people whom create income	1		
Education	High school class 7		
Source of income	**First income** Brickfield Chittagong	**Second income** Own land	**Third income** Day labor
Amount of income	4.000 per month for 9 months	Rice: 5.600 (irriborro, amon was damaged)	150 per day for 2 months
Savings	No		
Assets	1 goat		
Loans	55.000 for consumption during flood, medicine and when he has no job		
Contribution to ceremony	5 x 250 taka		
Role in the community	Volunteer		

Basic information

Chicken died due to cold weather.

He does not like to leave his family to go to Chittagong, but they need the money.

They drink enough water during drought but the vitamin does not stay in the body, they sweat the vitamin out of their body.

He is not changing his plans considering his amon rice production, he hopes the flood will come later or not damage the rice this year.

Observed climate change situation

Flood

He went 2 times to the shelter, his house is relatively high and he can sometimes stay in his house by elevating the floor with wooden stairs.

His platform of his house breaks, he repairs it himself or hires somebody.

Drought

His children get sick because in the hot weather they lose vitamins easier, they get too little vitamin B complex.

Learning capability

Housing

He higher his house so he does not always have to go to the shelter.

Income

He cultivates his own land with knowledge from his parents and the community.

Other information

Intervening criteria

The children received vaccines for common illnesses, everyone receives these. However, they missed two appointments so they only got 4 out of 6.

Interview 8

Gender	**Male**		
Age	65		
Household head	Yes		
Number of people in household	6		
Amount of people whom create income	3		
Education	High school class 7		
Source of income	**First income** Own land	**Second income** Son 1: Garments Dhaka	**Third income** Son 2: Garments Dhaka
Amount of income	No income last year Amon rice and jute failed		
Savings	No		
Assets	1 cow		

	1 chicken 10 little chicken
Loans	30.000 for food consumption during flood and for cultivation of his land
Contribution to ceremony	15 x 700 taka
Role in the community	Community leader and sometimes he goes to other communities to be a leader

Basic information

He is not changing his plans considering his own land with amon rice and jute production, his land is low and the flood comes easily.

He now also gave away his land and somebody has mortgage for this land. He has to pay 20.000 if he wants that part (20% of his total land) back.

15 chickens died because of cold weather or flood.

Observed climate change situation

Flood

Last year no income amon rice and jute production failed, his land is low and the flood comes easily.

Drought

Jute production is a bit damaged this year. He does not sleep very well during hot weather.

Learning capability

Income

He learned how to cultivate his own land from his parents and the community.

Other information

Intervening criteria

No.

Interview 9

Gender	**Male**
Age	65
Household head	Yes
Number of people in household	5
Amount of people whom create income	2
Education	No

Source of income	First income	Second income	Third income
	Brickfield Chittagong	Son: Brickfield Chittagong	Agricultural day labor Own land, which is sandy so they do not use it Fishing
Amount of income	4.000 per month for 6 months	5.000 per month for 6 months	150 per day for 2.5 month (husband) 200 per day for 2.5 month (son) Fishing sometimes 200 per day for 1-2 months
Savings	5.000		
Assets	No		
Loans	No		
Contribution to ceremony	4 x 600 taka		
Role in the community	Sometimes he is a leader in the community		

Basic information

Last 5 years he went 3 times to the shelter, his house gets damaged by tornadoes and floods. He repairs it himself but mostly not sufficient. His house is made of tin, which is a bit smaller. During flood he sometimes makes wooden / brick stairs.

During flood they make a raft from bamboo and banana tree leafs and trees, every family makes their own raft.

He is missing his family when he is in Chittagong, he is not together with his son in Chittagong, and they are in separate brickfields.

Observed climate change situation

Flood

He has no or too little communication with friends from other community or market place. They get no job. He is missing people.

When there is too much flood he has no fish.

Drought

6 chickens died because of hot weather and chicken pox, medicine did not work.

His own land is sandy land, so not useful.

Learning capability

No.

Other information

Intervening criteria

He receives 10 kg rice during flood.

Interview 10

Gender	**Female**		
Age	28		
Household head	No		
Number of people in household	5		
Amount of people whom create income	1		
Education	Primary class 3		
Source of income	**First income** Day labor earth cutting Chittagong	**Second income** Agricultural day labor	**Third income** Share cropping Fishing
Amount of income	4.500 per month for 9 months	250 per day for 1 month	Rice: 2.000 (amon) Jute: 2.500 Weed: 2.000 Yearly 150 per day for 2 months
Savings	No		
Assets	No		
Loans	3.000 For child treatment which was disabled, unfortunately the child died.		
Contribution to ceremony	2 x 200 taka		
Role in the community	Sometimes volunteer		

Basic information

They use a fishing stick/rod for fishing and a net, which they make themselves. He is fishing individually, he makes his own profit, and they go in a group but catch fish individually.

When she is giving birth a local doctor is coming to support her and gives her medicine during giving birth and afterwards.

Due to drought and flood they have less profit on their crops.

3 chickens died

Observed climate change situation

Flood

Amon rice was damaged.

Drought

They cannot plow for jute, it is too dry and pumping more water is too expensive. They use machines to plow but these are more expensive but she has no ox. They have to irrigate for their seeding of the jute, but irrigation is expensive, normally they do not have to irrigate.

Learning capability

Other information

Intervening criteria

She received 10 kg rice during flood.

Interview 11

Gender	Female		
Age	48		
Household head	No		
Number of people in household	5		
Amount of people whom create income	1		
Education	No		
Source of income	**First income** Agriculture day labor	**Second income** Share cropping	**Third income** Day labor
Amount of income	200 per day for 6 months	Rice: 8.000 (amon) Jute: 7.000 Weed: 2.500	100 per day profit for 3-4 months
Savings	No		
Assets	No		
Loans	15.000 cultivation of land, food and treatment		

Contribution to ceremony	2 x 150 taka
Role in the community	Husband is sometimes community leader

Basic information

She works in share cropping and he goes to agriculture day labor to solve their problem with less income due to share cropping damaged crops.

They live in a tin made house which is smaller.

They have no toilet at home; she goes in the open field. At the shelter there is a toilet but not sufficient for everybody.

Her house is high therefore she can sometimes stay in her house.

She has not her own tube-well, she uses from other families.

2 chicken killed by jackal, chickens live in her house.

Observed climate change situation

Flood

Effect on rice and jute production.

Drought

Damaged crops, they solve it by also doing agriculture day labor

Learning capability

Other information

Intervening criteria

They received 10 kg rice during flood.