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The Roles of Community Resilience and Risk Appraisal in Climate Change Adaptation

A Case Study of Resettled Communities in Chennai, India

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Summary

Although climate change is a global emergency, coastal cities in the Global South are among the most vulnerable. Chennai, the capital of Tamil Nadu in India, for instance, was hit by a tsunami in 2004 and regularly faces flooding and water scarcity. With the aim of climate change adaptation, the Greater Chennai Corporation is thus implementing urban eco-restoration projects that include the resettlement of slum-dwellers to the outskirts of the city. One of those resettlement sites, that was built on flood-prone marshlands, is Kannagi Nagar, the research site of this study. Also, its residents are exposed to risks of flooding and suffer heavily from the city-wide water scarcity, both circumstances that will be further intensified by climate change.

To understand how to deal with those challenges, this study analyses the roles of Community Resilience and Risk Appraisal of households in Kannagi Nagar towards adaptation behaviour in regard to flooding and water scarcity. This is done by applying socio-cognitive theories and analysing the situation of the residents in the resettlement colony with a mixed method approach of a household survey and additional in-depth interviews.

The results prove that Community Resilience, with its five parameters social network, social support, trust, place attachment and Collective Efficacy, has a significant positive influence on adaptation actions towards water scarcity and flooding in Kannagi Nagar. Additionally, it is substantiated that while Risk Appraisal has no direct effect, it is a positive moderator on the relationship between Community Resilience and adaptation behaviour. This shows that only when the inhabitants have supportive backing from their network and feel confident about the community's capabilities, a higher awareness of the risk can further increase the number of adaptation measures taken. Thus, to enable people to take adaptive action, merely proclaiming the threat of climate change is insufficient. Rather, the focus should be put on (re-)building resilient, trusting communities, who are well connected, able to help themselves and believe in their power to make a difference. For future-oriented urban policies for resettlement schemes and climate change communication these results imply the need to place more weight on implementing community-building initiatives to enhance the citizen's adaptive capacity in times of a climate crisis.

Keywords

Community Resilience, Risk Appraisal, Climate Change Adaptation, Resettlement, India

Acknowledgements

My intrinsic motivation for this thesis is the fact that climate change is a question of social (in)justice. While we, the Global North and the wealthy, live a secure, luxurious life, we do this on the expenses of the Global South and the poor. The privileged will have the finances and structures to adapt, but the climate crisis will impact the less fortunate dramatically, although they did the least to create it. I firmly believe that building strong, resilient communities could unleash superpowers in the world-citizens who are most affected by climate change. Hopefully I was able to add, with this thesis, my small contribution of support.

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I dedicate this thesis to Opa, who would have celebrated it the most of all,
and to Mama & Papa who love and support me always and unconditionally.

Abbreviations

CCRAM	The Conjoint Community Resilience Assessment Measurement
CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
GDP	Gross domestic product
H1-H5	Hypothesis 1 - Hypothesis 5
IHS	Institute for Housing and Urban Development
IPCC	Intergovernmental Panel on Climate Change
MPPACC	The Model of Private Proactive Adaptation to Climate Change
SEM	Structural Equation Model
TNSCB	Tamil Nadu Slum Clearance Board

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Chapter 1: Introduction

Climate change is a unique challenge in history due to its complexity, global scale and the century-long timeline (van der Linden 2015). Additionally, while it is principally a slow process that is not experienced directly, it is accumulative and after reaching a tipping point, irreversible (van der Linden 2015). This makes the concept of climate change even more difficult to grasp, and also harder to acknowledge that the risk needs to be mitigated and adapted to promptly. To understand how to deal with this un-precedented global challenge, scholars and policy makers started to move from a global level of action to a local one and explored the individual's cognitive processes of adaptation (Mortreux and Barnett 2017). In recent years, academics were able to prove that people perceive climate change impacts as more manageable when they believe that they individually and collectively are capable of assuming effective adaptive behaviour (Adger 2003, Grothmann and Patt 2005, Thaker et al. 2016, Babcicky and Seebauer 2019). Some of the social-cognitive factors that presumably influence adaptive behaviour addressing climate change will be explored in this research. More precisely, the aim is to understand the roles of Community Resilience and Risk Appraisal towards household adaptation behaviour in regard to flooding and water scarcity in the context of a resettlement site in Chennai, India.

Before delving into an analysis of the existing literature, the following sub-chapters provide an overview of the theoretical and practical background for this study. Further, the research problem, the research objective and the research questions are presented. Additionally, the significance, the scope and the limitations of the study are discussed.

1.1 Background

Although climate change is a global emergency, its effects like sea-level rise and extreme weather events are experienced in some places more than in others; for instance, low-lying, coastal cities are especially affected (IPCC 2012). In order to ensure safety for their citizens, municipalities around the world draft and carry out first local climate change adaptation strategies and build adaptive capacity on the ground (IPCC 2014, Cinner et al. 2018). Yet, their investments are often based on a limited understanding of adaptive capacity, assessing and supporting mostly the material assets of the actors, while ignoring the social-cognitive aspects (Grothmann and Patt 2005). The adaptation strategies normally entail technical solutions, such as infrastructure upgrading and early risk warning systems; or nature-based solutions, like ecological restoration of rivers or mangrove forests as coastal protection structures (IPCC 2014). With those initiatives social justice is not always ensured as the best protection is mostly guaranteed for the wealthy, while the poor, especially in informal settlements, are benefitting less from costly adaptation installations (Dow et al. 2006, Mearns and Norton 2010, Popke et al. 2016, Thaler et al. 2018). In the Global South, the most common strategy to provide protection for slum dwellers from extreme weather events is the disruptive internal resettlement (Arnall 2018).

The chosen case study for this research is one of those resettlement sites: Kannagi Nagar in Chennai, the capital of the state Tamil Nadu in India. After the devastating tsunami in 2004 and the flooding in 2015, the Greater Chennai Corporation implemented several urban renewal projects, with the proclaimed aim of climate change adaptation, that included the eviction of informal settlements (Coelho and Ramen 2013, Ramya and Peter 2014). One of the highly controversial initiatives is the resettlement of slum dwellers from the waterfront of the river Cooum and Adyar to the flood-prone marshlands at the outskirts of the city, like Kannagi Nagar. Those swamplands provide essential ecosystem services, namely collecting and storing

water during monsoon season, minimizing the risk of flooding, and working like reservoirs during dry season, feeding the groundwater table. However, by reclaiming the land and building on those multifunctional nature sites, the loop is broken and the whole city of Chennai becomes more vulnerable to flooding and also water scarcity (Coelho and Raman 2010, 2013). Also, the households of the resettlement colony Kannagi Nagar face high risks of flooding on those old marshlands and suffer heavily from the city-wide water scarcity. Furthermore, through the relocation many lost their jobs, dropped out of school and their essential social support systems got ripped apart (Cernea 1997, Jain et al. 2017). To adapt and cope with those circumstances, not only financial and tangible assets are needed, but also social capital (Grothmann and Patt 2005). This process of coping with and the ability of adapting to disturbances based on social assets is generally called 'Community Resilience' in academic literature (Magis 2010, Islam and Quek 2014, and Aldrich and Meyer 2015). The appraisal of Community Resilience is theorized to be a potential catalyser of Climate Change Adaptation Behaviour, especially in poorer communities with few other support systems and resources (Paton and Johnston 2001, Hackenbroch et al. 2008, Leykin et al. 2013, Kais and Islam 2016). This hypothesis will be explored in this research with Kannagi Nagar and its challenging circumstances as the ideal case study site.

1.2 Problem Statement

Studies assessing climate change adaptation processes often focus on the effects of tangible and measurable resources, such as infrastructure and income (Mortreux and Barnett 2017). This asset-based approach is, however, not sufficient as it is marginalizing social-cognitive processes that are influencing adaptation intentions (Grothmann and Patt 2005). It ignores that, according to the findings of Grothmann and Patt (2005), a lack of risk and adaptation appraisal create a cognitive barrier for taking adaptive action. Moreover, the power of the community to initiate and support the adaptive behaviour of its members, is underrepresented (Thaker et al. 2016, Babcicky and Seebauer 2019). While the influence of Risk Appraisal is still debated, the positive role of Collective Efficacy is clearer. Thaker and his colleagues were the first to proof the significance of Collective Efficacy in enhancing Climate Change Adaptation Behaviour in the Indian context (Thaker 2012, Thaker et al. 2016). However, they proclaimed the need for "future research on other critical variables such as values, cultural orientations, and social capital to test the relative importance of Collective Efficacy and values in enhancing adaptive capacity" (Thaker et al. 2016, p. 32). Also, Babcicky and Seebauer (2017, p. 1033) propose "including social capital as an explanatory factor in socio-psychometric models […] on actual flood mitigation behaviour" to provide better insights for future climate change adaptation research. These statements underline the need for more thorough studies on which social aspects influence cognitive triggers for Climate Change Adaptation Behaviour.

1.3 Research Objective

The objective of this study is to improve the understanding of the effects of Community Resilience and Risk Appraisal on Climate Change Adaptation Behaviour of the resettlement colony Kannagi Nagar in Chennai, India. This is proposed to be done by applying socio-cognitive theories and analysing the situation of the households in the resettlement case study. As briefly discussed above, the study builds on a growing body of literature, especially on Grothmann and Patt's (2005) Model of Private Proactive Adaptation to Climate Change with its main aspects Risk Appraisal and adaptation appraisal, and on the empirical research of Thaker et al. (2016) on Collective Efficacy in India. Additionally to those scholars' approaches,

a stronger community-based perspective is sought, reflected by the concept of Community Resilience.

1.4 Research Questions

The research question and the four sub-questions for this thesis are;

How does Community Resilience and Risk Appraisal of resettled households in Kannagi Nagar in Chennai, India influence their Climate Change Adaption Behaviour addressing water scarcity and flooding?

1. What are the key household climate change adaption actions, specifically tackling flooding and water scarcity, in Kannagi Nagar?
2. Which factors constitute Community Resilience and how are they interconnected?
3. What is the role of Community Resilience towards household adaptation behaviour?
4. What is the role of Risk Appraisal towards household adaptation behaviour?

1.5 Significance of the Study

This research aims to build on conclusions of existing literature and to add valuable findings from a resettlement site. The scholars Grothmann and Patt (2005) and Thaker et al. (2016) found proof for the positive influence of collective and self-efficacy towards adaptation behaviour addressing water scarcity and flooding in Germany and India. Additionally, Lo et al. (2015) and Babcicky and Seebauer (2017) provided results regarding positive effects of social capital towards the intention to adapt to flooding in China and Austria. While this reflects that the concepts have been investigated separately already, a combination of the aspects of Risk Appraisal, Collective Efficacy, social capital – or the here chosen broader concept of Community Resilience – and climate change adaptation, has, to the best of the author's knowledge, not been empirically researched yet.

The significance of the study further gets supported by the approach to test the theoretical framework quantitatively in a resettlement site in India. The case study of Kannagi Nagar in Chennai was chosen because of four reasons. First, as residents of a tropical coastal city, the local communities of Chennai are especially affected by climate-change-induced disasters. Kannagi Nagar itself is an adaptation response to climate change, as the residents have been displaced because of extreme weather events and eco-restoration projects. However, as Kannagi Nagar is located on marshlands, the risk of flooding is still high and further adaptation measures are needed (Coelho and Raman 2010). Second, the inhabitants of Kannagi Nagar face social disarticulation, the disruption of community ties and trusted relationships and one of the eight risks of resettlements (Cernea 1997, Jain et al. 2017). As the support networks who are necessary for coping with hazards could get destroyed through relocation, resettlement sites become especially vulnerable to disasters. However, many of the inhabitants of Kannagi Nagar, who have faced this social disarticulation, are assumed to have had enough time to establish new and revive old community ties since their resettlement over a decade ago. The resettlement colony thus acts like an incubator to re-build communities, leading to an interesting mix of different levels of sense of community of the residents. Third, the disaster experience in Kannagi Nagar is high, as the households already have defied the tsunami in 2004, the disastrous flooding in 2015 and also the extreme water scarcity in summer 2019, which happened during the field visit for this study. This equips the locals with valuable risk and mastery experience, two important aspects for decision-making regarding adaptation (Grothmann and Patt 2005, Thaker et al. 2016). This combination of contextual, social and

cognitive reasons make the over 20 year-old resettlement colony Kannagi Nagar in Chennai a hotspot for climate change adaptation research and can also add highly topical empirical findings to the existing body of literature.

1.6 Scope and Limitations

While the research of Thaker et al. (2016) focused on a national level, this study aims to zoom into a local scale, exploring the Community Resilience and Risk Appraisal of the resettled inhabitants of Kannagi Nagar. New insights into effective household climate change adaptation strategies towards flooding and water scarcity shall be provided for the context of urban regions of India, and especially mass relocation sites, that are regularly affected by extreme weather events.

As time and finances were constrained, the depth and breadth of the study is limited. Additionally, and especially, the logistical aspect of first creating a theoretical framework and appropriate hypotheses and only afterwards exploring the case study site personally, creates a limitation. Truly reflecting the complexity and the challenges that residents of Indian resettlement sites face, in a theoretical treatise with quantitative data, written by an author with an Eurocentric academic socialisation, is nearly impossible. And even though the author tried to be reflexive of personal biases and well prepared by literature, this top-down instead of an on-site exploratory approach nevertheless creates the strongest limitation of this study.

1.7 Structure of the Study

This research is clustered in five chapters, including the Introduction, the Literature Review, the Research Design and Methods, the Case Study, Data Analysis and Discussion and, as the last part, the Conclusion. The first chapter introduces the theoretical and practical background in which the study is embedded and presents the research questions. In the Literature Review the concepts of climate change adaptation assessments, Risk Appraisal and Community Resilience are examined and the different approaches and findings of existing literature discussed. The chapter on Research Design and Methods elaborates on the strategies of the data preparation and collection. The fourth chapter first gives an overview of the case study site, then analyses the quantitative and qualitative outputs and discusses them. The final chapter summarizes the findings of the study by answering the research questions and offers implications for urban resettlement policies and further research.

Chapter 2: Literature Review

The Literature Review is composed of four parts, namely an introduction to the resettlement context, an elaboration on the concepts of climate change adaptation assessments and Community Resilience, and concluding, the presentation of the theoretical framework and the four hypotheses. The first sub-chapter introduces the most important definitions of resettlements, the context in which this research with its case study site Kannagi Nagar is embedded. In the second sub-chapter the concept of climate change adaptation is explained. Different household adaptation strategies are presented and the asset-based adaptation assessments critically analysed. Following, a cognitive approach for adaptation behaviour is introduced, focusing on the Model of Private Proactive Adaptation to Climate Change and its two main aspects Risk Appraisal and Adaptation Appraisal. The third sub-chapter examines

the concept of Community Resilience in relations to climate change adaptation. The social capacity parameters of Community Resilience and their interconnections are thoroughly explored. In the fourth and final sub-chapter the most critical findings of the existing literature are summarized, combining them into an innovative theoretical framework, and deriving five hypotheses.

2.1 The Resettlement Context

Resettlements and evictions are very pressing topics, as displacements, either forced by municipalities as an adaptation strategy or directly through extreme weather events, are predicted to lead to 250 million climate refugees by 2050 (Barret 2012). To introduce the resettlement context for the research at hand, this sub-chapter defines the necessary keywords, namely displacement, relocation and resettlement, and presents the concept of social disarticulation by Cernea (1997).

In the development literature the term involuntary displacement is often used interchangeably with the expression of forced resettlement (Quetulio-Navarra 2014). However, other scholars differentiate and consider displacement as the multitude of deprivations faced, while relocation refers to the movement from a former home to a new place which hopefully ends in a resettlement, the provision of housing and rehabilitation (UN Habitat 2010, Quetulio-Navarra 2014). Involuntary displacement and its synonym forced eviction is defined by the UN as „the permanent or temporary removal against their will of individuals, families and/or communities from the homes and/or land which they occupy, without the provision of, and access to, appropriate form of legal or other protection“ (UN Habitat 2010, p. 151). Relocation describes “the physical transfer of individuals or groups of people from their usual home (place of origin) to another location (place of relocation)“ (UN Habitat 2010, p. 152). Resettlement refers to the „provision of shelter, basic services and infrastructure, livelihood opportunities and security of tenure to displaced households in the place of relocation“ (UN Habitat 2010, p. 152). Thus, while displacement is the act of removal from the original home, relocation signifies the movement to a new place and resettlement stands for the provided support to re-build the livelihood.

The displacement of people can be caused by, firstly, development projects like dams, highways, river restoration and other infrastructure improvements that are initiated by governments and companies (Quetulio-Navarra 2014). Secondly, by armed conflicts and thirdly by natural disasters like earthquakes, flooding and desertification, which are increasingly triggered by climate change (World Bank 2004, Quetulio-Navarra 2014, UN Habitat 2010). In the case study site and resettlement colony Kannagi Nagar in India, for example, the reasons for the displacement of the residents are development projects – the river restoration of the Adyar and Cooum River and the adjacent 19-km expressway – and natural disasters like the tsunami in 2004. The implementation of those resettlements can vary greatly in its quality and effects. Although the World Bank calls for planned resettlement schemes with consent by and choice for the affected people, most relocations are still forced and have disruptive impacts on access to resources, social cohesion and cultural identity (World Bank 2004, Mathie and Cunningham 2005, Adger et al. 2009, Wilmsen and Webber 2015, Arnall 2018). The widely cited Impoverishment Risks and Reconstruction Model for Resettling Displaced Populations by Cernea (1997) identifies eight basic risks of resettlement schemes: loss of land, shelter, employment and of access to common resources, economic marginalization, increased morbidity and mortality, food insecurity, and social disarticulation. The main focus of this study is on the eighth Impoverishment Risk: Social Disarticulation. Cernea (1997) describes how a displacement disrupts the community life and the sense of

belonging, fragmenting the social connections and destroying the life-sustaining, self-organized informal networks of interaction and reciprocity. This can lead to a "state of anomie", decreased participation in group initiatives around common needs and the feeling of "powerlessness, dependency, and vulnerability" (Cernea 1997, p. 1575f). Cernea (1997) further criticises that those aspects are far too often not perceived and incorporated in the resettlement schemes by the authorities and remain uncompensated. Recreating the former lively communities in the new places is often difficult, especially when the fluctuation in those resettlement locations is high and new citizens join regularly, factors that are also present in the case study site Kannagi Nagar (Cernea 1997, Hackenbroch et al. 2008, Coelho and Raman 2010, Jain et al. 2017).

However, it is exactly the sense of community and the capacity for self-organisation that are needed in resettled communities when new challenges need to be faced (Cernea 1997, Rogers and Wang 2007, Singer et al. 2015, Wilmsen and Webber 2015). This study argues that extreme weather events are some of those challenges, for which the ability to mobilize communities to act together, is crucial. How those concepts of resilient communities and climate change adaptation are built and how they relate to one another, is explored in the following sub-chapters.

2.2 Climate Change Adaptation

Climate change is a global emergency, that needs immediate mitigating, adapting and transformative action from the household level up to the international scale (Espinosa 2018, UNFCCC 2019). As many countries, especially in the Global South, are experiencing the first destructive effects of climate change, those regions are already implementing adaptation measurements to be safe from extreme weather effects and sea-level rise (IPCC 2012, IPCC 2014, Singh et al. 2016, Arnall 2018, Cinner et al. 2018, Singh 2018b). The definition for adaptation to climate change by the Intergovernmental Panel on Climate Change (IPCC) is "the process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities." (IPCC 2014, p. 5). Adaptation behaviour can either be anticipatory or reactive and its effectiveness depends on the associated adaptive capacity of the actor (Smit and Wandel 2006). The IPCC defines adaptive capacity as "the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences" (IPCC 2001, p. 6). Adaptive capacity is context-specific and scale-dependent, which makes generalizability across cultures and countries difficult and explains the high number of different assessment methods in academia (Smit and Wandel 2006, Vincent 2007, Siders 2019).

The following sections outline the current discussion on climate change adaptation assessments. First, different scales and kinds of household adaptation behaviour are explored. Second, the traditional asset-based adaptation assessment approach and its limitations are analysed. Third, a cognitive approach, to understand why adaptation actions are taken or not, is introduced. The Model of Private Proactive Adaptation to Climate Change acts as a theoretical base of this research and introduces first findings about the roles of Risk Appraisal and Adaptation Appraisal. As conclusion of the sub-chapter, an outlook is given on how the cognitive approach towards adaptation can be extended by taking the social context of a community into account.

2.2.1 Climate Change Adaptation Strategies

Climate Change adaptation strategies in the context of flooding and water scarcity can vary by actor (individual, community, governmental) and in scale (maladaptation, no adaptation, coping, adaptation). Figure 1 illustrates the different scales of household response strategies.

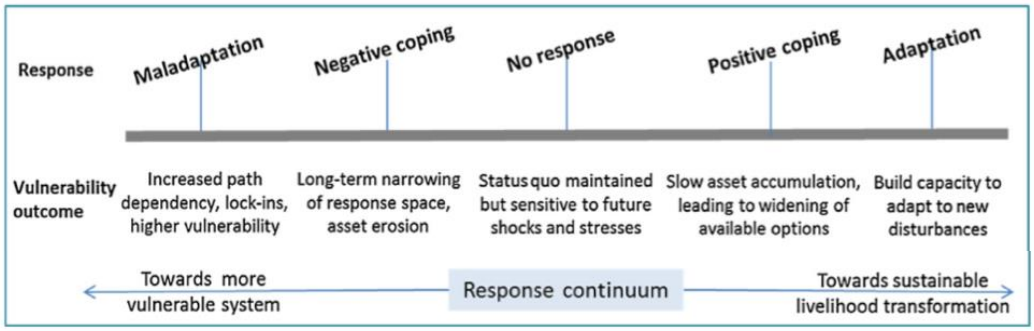


Figure 1: Household response strategies conceptualised along a response continuum (Singh et al. 2016, adapted)

Behavioural changes in a short-term time frame, which are reactive and implemented ad hoc, are defined as coping strategies. Positive coping strategies make use of available skills, resources, and opportunities which improve the current situation and ensure survival (IPCC 2012, Singh et al. 2016, (Mochizuki et al. 2018). Through incremental changes, social learning and feedback loops those coping strategies can transform into proactive adaptation strategies (Fabricius et al. 2007, Singh et al. 2016). Adaptation behaviour is the ability to anticipate, has a long-term timeframe and includes shifts in practices, adjustment to trends and improvements of resilience (Singh et al. 2016). Deriving from Figure 1, the least effective strategies are avoidant maladaptation and negative coping strategies, both leading to a decay of resilience. Here the actors are motivated by short-term gains or opt for avoidant reactions like fatalism, denial and wishful thinking (Grothmann and Patt 2005, Singh et al. 2016). This way physical damages cannot be prevented, only the suffering from fear and other negative emotional burdens (Grothmann and Patt 2005). Maladaptive responses and negative coping strategies can be well-intentioned but have unsuspected, negative externalities (Singh et al. 2016). The no-response scenario implies keeping the current status from drifting into devastation but without improving the capacity to adapt to future stressors (Singh et al. 2016). The presented strategies are part of a response continuum and transform over time. Hardly ever only one strategy is chosen, rather those strategies are combined and interfere with one another (Singh et al. 2016). Thus, Singh et al. (2016) conceptualize the decision-making about adaptation behaviour as a process with iterations, feedback loops and continuous adjustments, instead of a linear sequence. To reflect this continuum, this study will assess not only adaptation but also the subset of coping strategies.

The various actors that choose from a range of available behaviours are individuals, households, communities and governments on the regional and national scale (Adger 2003a, Singh 2018a). Individuals and households respond to personally relevant events in their vicinity, communities aim to reduce collective risk and governments address the society as a whole (Adger 2003a). For this research, the household is chosen as the unit of assessment, as most decisions are taken within the social context of the family that is sharing a home. The variety of coping and adaptation actions of households is broad and the literature exploring behaviour tackling flooding and water scarcity mostly in rural but also in urban contexts in the Global South is rich. Typical adaptation strategies in the urban context are rainwater harvesting and ensuring un-blocked drainage systems (Singh 2018b). Positive coping strategies are taking loans from relatives and barriers to prevent floods to enter the house (Koerth et al. 2013, Singh et al. 2016, Singh 2018b), while common maladaptive coping strategies are praying and

including children in the workforce. Adaptation actions that the households take by joining communal initiatives are protests, women self-help groups, saving groups for collective investments and support groups for times of disaster (Raman and Narayan 2013, Eakin 2016, Singh 2018b).

2.2.2 The Asset-based Approach to Adaptation Assessments and its Limitations

Historically, adaptive behaviour was measured with an asset-based approach, building on the Sustainable Livelihood Framework (Scoones 1998) and Sen's Capabilities Theory (1984). Those assessments concentrated on the availability of and access to natural, physical, financial, social and human assets (Scoones 1998), like in the large-scale assessment by the Economics of Climate Adaptation Working Group (2009). Consequently, several scholars like Smit and Pilifosova (2001) and Adger (2003a) have come to the widely spread conclusion that communities and countries, which have few assets, meaning limited access to economic and natural resources, weak infrastructure, instable and corrupt institutions and little access to technology, have a poor capacity to adapt. Yet, in the past fifteen years, this asset-based approach got increasingly criticized (Mortreux and Barnett 2017). Scholars understood that "adaptive capacity is not simply about having the necessary resources at hand, but also about the willingness and capability to convert resources into effective adaptive action" (Cinner et al. 2018, p. 1). Grothmann and Patt (2005) were among the first to highlight and empirically prove the limitations of this asset-based approach. Many traditional assessments, like those by Yohe & Tol (2002) and Vincent (2007), use for instance the GDP or other economic, financial or physical figures as main determinants, which might be an appropriate but not the most significant indicator (Grothmann and Patt 2005). Grothmann and Patt (2005, p. 203) argued that "if agents systematically underestimate their own ability to adapt, this qualifies as a more important 'bottleneck' for adaptation than the objective physical, institutional or economic constraints". Also several case studies show that, although the wealthier people might be more protected by infrastructure and thus supposedly have a stronger adaptive capacity, they were adapting worse than households with an allegedly lower capacity (Coulthard 2008, Moser 2009, Nielsen and Reenberg 2010). The tangible assets only constitute the base on which people take decisions, but do not directly translate into adaptive action. The important bottleneck for adaptation is the black box of the cognitive decision-making process, including Risk and Adaptation Appraisal (Grothmann & Patt 2005, IPCC 2014), which is presented in the following chapters.

2.2.3 The Cognitive Approach to Adaptation Assessments

A growing body of research from the last decade has established that cognitive factors are a crucial part of adaptive capacity assessments and even the fourth IPCC report (2014) dedicates several chapters on social context of decision-making, also presenting several theories around the process of decision-making (Mortreux and Barnett 2017). The first and most well-known theory is the Protection Motivation Theory by Rogers (1983) which postulates that when confronted with a risk, people make two appraisals. With the threat appraisal the likelihood and the severity of the risk are evaluated (Truelove et al. 2015). With the coping appraisal, self-efficacy and the effectiveness and the costs of the action against the threat are estimated. If perception of an environmental threat and coping appraisal are high, protective action is taken (Grothmann and Reusswig 2006, Babcicky and Seebauer 2019). If the self-efficacy is low, people opt for maladaptive actions that minimize the fear of the risk but do not diminish the actual threat (Truelove et al. 2015). Consequently, both risk and coping appraisal are needed, but ultimately the efficacy belief enables human agency (Bandura 1997, Grothmann and Patt

2005, Babcicky and Seebauer 2019). Mostly deriving from Rogers' Protection Motivation Theory (1983), Grothmann and Patt (2005) published one of the most influential frameworks of the field, the Model of Private Proactive Adaptation to Climate Change (MPPACC), which is presented and discussed below.

2.2.3.1 The Model of Private Proactive Adaptation to Climate Change

Grothmann and Patt (2005) developed the influential cognitive model on climate change adaptation, including perceived adaptive capacity and risk perception as the two main factors. Their Model of Private Proactive Adaptation to Climate Change (MPPACC) illustrates adaptation as a decision-making process, dependent on individual perceptions (Figure 2).

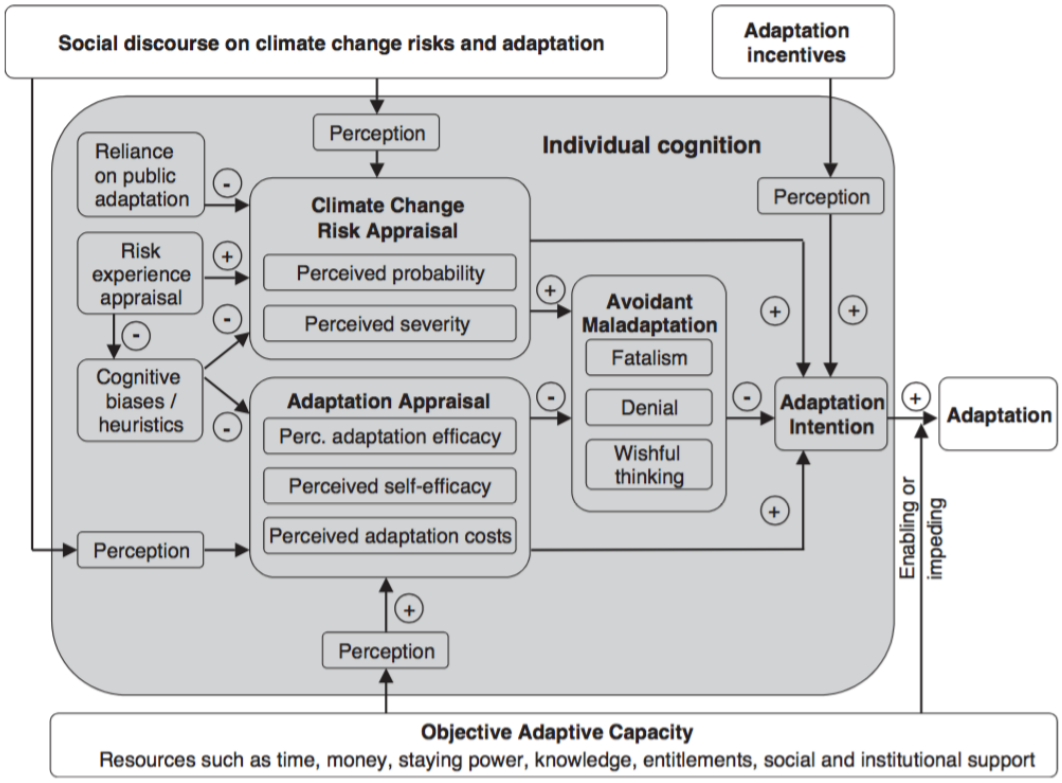


Figure 2: The Model of Private Proactive Adaptation to Climate Change (Grothmann and Patt 2005)

The MPPACC divides Adaptive Capacity in external clusters, displayed as white boxes, and internal clusters, marked as grey boxes. The external cluster includes the Social discourse on climate change risks, Adaptation incentives and the Objective Adaptive Capacity, which stands for the traditional asset-based approach. The perceptions of those three factors influence the internal cluster, where the decision-making process takes place. This way the asset-based and the cognitive approach are elegantly combined. The internal cluster's two main factors are Climate Change Risk Appraisal and Adaption Appraisal, which are influenced by perceptions, experiences and reliance and can be distorted by Cognitive biases. The main message of this framework is that, if a low adaptive appraisal is combined with a high-Risk Appraisal, people are not likely to take action, rather their response would be Avoidant Maladaptation, namely Wishful thinking, Denial and Fatalism. Only if people are also aware of their self-efficacy and believe that their adaptation actions would be effective and worth the effort, people take adaptive actions.

2.2.3.2 The Two Main Factors: Risk Appraisal and Adaptation Appraisal

The key factors of the MPPACC framework are the Climate Change Risk Appraisal and the Adaption Appraisal. In the following they will be analysed more thoroughly.

Grothmann and Patt (2005) postulate the relative risk perception as the starting point of climate change adaptation, as only after the acknowledgement of risk, the adaptation effectiveness and efficacy are considered and then response behaviour realized. Risk Appraisal is defined as a judgment of probability and severity of a disruptive event (Thaker 2012). Perceived probability marks the expectancy of being exposed to climate change impacts, for example that the flood reaches the resident's house (Grothmann and Patt 2005). Perceived severity is the belief of how harmful the impact would be to things the resident values, for instance the resident's judgment that the flooding would damage property. Those judgements are relative to the individual's assessment of how severe and urgent their other problems or challenges are (Grothmann and Patt 2005). Singh (2018b) adds that experience and memory are influencing Risk Appraisal but can be largely deformed by cognitive biases. Recent events are, for example, more frequently and with more clarity recalled, the same applies for events that one was affected by more. Those individual memories of past extreme weather events then shape definitions and expectations of future climate risks (Singh 2018b).

The importance of Risk Appraisal is debated about as some scholars see it as a determinant of behaviour (Wakefield et al. 2006, Gifford et al. 2011, Elrick-Barr et al. 2017), which is based on the motivational hypothesis, that proclaims "that people undertake precautionary measures to reduce the risk they perceive as being high" (Bubeck et al. 2012, p. 1482). Bubeck et al. (2012, p. 1481), however, proved with their literature review that this positive relationship "is hardly observed in empirical studies". While it is clear that people need to be aware of a threat to react to it, Risk Appraisal, as such, is not sufficient to trigger adaptation behaviour (Bubeck et al. 2012, Lo et al. 2015). While some scholars report a very weak positive correlation (Bubeck et al. 2013), some see no significant correlation whatsoever (Bubeck et al. 2012, Lo et al. 2015) and others even detect a negative correlation (Thaker et al. 2016). These results are in line with the Roger's (1983) Protection Motivation Theory and also reflected in the MPPACC framework, implying that a high perception of risk needs to be combined with Adaptation Appraisal in order to lead to a protective response (Grothmann and Patt 2005, Bubeck et al. 2012).

Adaptation Appraisal, as characterized by Grothmann and Patt (2005), has three elements. First, perceived adaptation efficacy, which is defined as „the belief in adaptive actions or responses to be effective in protecting oneself or others from being harmed by the threat" (p. 203). Second, perceived adaptation costs, which are „the assumed costs [e.g., monetary, personal, time, effort] of taking the adaptive response" (p. 203). And third, perceived self-efficacy, „a perceived ability to actually perform or carry out these adaptive responses" (p. 203). Self-efficacy is according to Bandura (2000) and his Social Cognitive Theory the primary driver of human behaviour and essential when exploring people's differing responses to climate change (Roser-Renouf and Nisbet 2008, Thaker 2012).

2.2.3.3 Relevance Today and New Frontiers

The importance of Grothmann and Patt's framework is that the precision of predicting action for adaptation was higher by using their framework than with the asset-based approach. They were able to prove that Risk Appraisal and especially Adaptation Appraisal are important determinants of human action. Other scholars, for instance Kniveton et al. (2011), Kuruppu and Liverman (2011), Smith et al. (2011) and Hu et al. (2018), based their research on

Grothmann and Patt's integrative framework and confirmed that also their psychological models were more precise in explaining one's adaptive behaviour than the asset-based model.

The most recent historical abstract of the development of adaptive capacity research, focusing largely on the results of Grothmann and Patt, was undertaken by Mortreux and Barnett (2017). They aimed to push the research frontier and summarized six cognitive factors which are, based on their research findings, central to transforming adaptive capacity into action: personal experience, place attachment, expectations of authorities, risk attitudes, household composition and competing concerns. However, while Grothman and Patt and Mortreux and Barnett analyse the adaptive capacity of individuals and their self-efficacy, other scholars like Truelove (2015), Thaker (2012) and Babcicky and Seebauer (2019) started to focus on the behaviour of the individual within its social context. Inspired by Grothmann and Patt's framework and building strongly on the Social Cognitive Theory by Bandura (1997), Thaker (2012) identified Collective Efficacy as a community-based predictor of Climate Change Adaptation Behaviour. He argues that Grothmann and Patt „largely ignore the role of social norms and beliefs that may constrain adaptive actions taken by individuals" (Thaker 2012, pp. 25). Further, he elaborates that people, especially of collective communities like in India, do not only depend on their own competences to cope with the challenges and disasters they face. Rather they organize themselves into support groups, associations or cooperative communities and take collective action to resolve problems (Thaker 2012). This community-based perspective on climate change adaptation will be further explored in the following chapters.

2.3 Community Resilience

In the last decade, the research on climate change adaptation has moved its focus from top-down policy-perspectives, to a local community and bottom-up focus (Rapaport et al. 2018). This has several reasons. First, because a community-approach frames climate change as a local problem, it is perceived as more manageable, which strengthens the perceived adaptive capacity (Adger 2003b). Second, especially in poorer contexts the official emergency planning often does not reach or is not taken into account, so affected communities need to rely on their local resources (Rapaport et al. 2018). Third, Norris et al. (2008) underline that extreme weather events happen to entire communities – they are "exposed together and must recover together" (p. 145). Especially in collectivist cultures, like in the case study of this research, an individual focus might not be the most accurate representation of the reality of the people (Chadda and Deb 2013, Thaker et al. 2016). In collectivist cultures the perception of how effective and resilient the whole community is together, might be more accurate in predicting behaviour (Adger 2003a, Thaker et al. 2016). This perspective stems from culturally-embedded beliefs that honour collective goals, and endorse communal action and self-deprecation (Paton et al. 2008). This approach is also reflected in literature: The IPCC (2014) stresses in its fifth report, that when analysing climate change adaptation, the community aspect needs to be taken into account. Also, Aldrich (2010) argues, that not the scale of the disaster or the financial aid are most decisive for the recovery processes, rather it is the strength of social networks, trust and civic engagement. He gives the example of the tsunami in 2004 that killed 8.000 and left more than 300.000 people homeless in the state of Tamil Nadu, India. Aldrich (2010) shows that due to the high level of social capital, the communities "rebuilt almost all of its schools, fixed 75% of the damaged housing stock, and put most of its fishermen back to work" (p. 3) within a year of the disaster. That Community Resilience is a crucial element for disaster preparedness and a measure for the likelihood of successful adaptation strategies, is proclaimed also by scholars like Paton and Johnston (2001), Paton et al. (2001), Leykin et al. (2013), Truelove et al. (2015), Faulkner et al. (2018) and Rapaport et al. (2018). Paton et al. (2001)

combine sense of community, social support, self-efficacy under Community Resilience in the Protection Motivation Theory and test it empirically in the context of volcanic hazards in New Zealand. Truelove and her colleagues modified Rogers' (1983) Protection Motivation Theory, drew from Grothmann and Patt's (2005) framework and added the notion of social appraisal to the concept of climate change adaptation decisions. In their framework, Truelove et al. (2015) put a focus on perceived norms and community identification, which includes attachment and trust. Thaker (2012) was the first to proof the positive influence of Collective Efficacy on adaptation towards water scarcity in the Indian context. He based his theory strongly on Bandura (1997) and was also able to show that especially positive mastery experience, a communal success of overcoming a disaster, increases Collective Efficacy (Thaker 2012). Also Lo et al. (2015) and Babcicky and Seebauer (2017, 2019) explore the influence of social capital and Collective Efficacy, two aspects of Community Resilience, towards flooding. In their paper from 2017 Babcicky and Seebauer find a positive relation between structural social capital, namely trust and involvement, towards self-efficacy and between structural social capital, namely social ties and support, and perception of adaptive capacity towards flooding in the Austrian alps. In their paper from 2019 Babcicky and Seebauer look at the influence of Collective Efficacy on self-efficacy in a flood-prone German city. The researchers define Collective Efficacy as a combination of social capital and community efficacy. Their findings are that social capital has no effect on self-efficacy, while Collective Efficacy has (Babcicky and Seebauer 2019). Meanwhile, Lo et al. (2015) were able to proof that social capital, precisely networks, norms and trust in social life, is crucial for fostering adaptation intention towards flooding in a Chinese urban community.

These studies and their findings are used as a starting point for this research, but a more diverse set of parameters of Community Resilience and understanding the direct influence on adaptation behaviour is aspired to. Thus, the following sections explore several factors that create Community Resilience. First, community and Community Resilience are defined and varied theoretical approaches examined. Deriving from that review, six influential social capacity parameters are chosen and further described. Concluding, the associations and interdependencies between these variables are explored, based on recent literature.

2.3.1 Defining Communities and Community Resilience

Communities are defined as a network of people within the same geographic boundaries, that have a shared identity, interests and fate (Norris et al. 2008, Samuel et al. 2014). Together they possess communal resources and their social interactions lead to a certain degree of self-organization and collective action (Chaskin 2008, Samuel et al. 2014, Rapaport et al. 2018). For this case study, the term community is specifically used to describe a socially meaningful group of people who have been resettled to the same site.

Community Resilience is defined by the scholarship in various ways, with the "community's ability to deal with crises or disruptions" (Leykin et al. 2013, p. 313) as the common denominator and two main characteristics: re-establishing functions and cooperation (Kulig 2008, Magis 2010, Sherrieb et al. 2010, Pfefferbaum and Klomp 2013, Islam and Quek 2014, Aldrich and Meyer 2015, Rapaport et al. 2018). Combining the descriptions by Magis (2010, p. 401), Islam and Quek (2014, p. 208) and Aldrich and Meyer (2015, p. 255), the following new definition is created for this research: Community Resilience is as a community's ability to deal with and recover from stresses or disasters through cooperation and strong social cohesion which reinforce networks of trust and support in times of need and uncertainty.

2.3.2 The Social Capacity Parameters of Community Resilience

Community Resilience is a combination of a variety of interconnected social capacities, that have been identified by numerous authors. In the following, an overview of the different social capacity parameters is given, of which six are selected for this research.

For Kulig (2008) Community Resilience is a process, which she visualized in her Updated Community Resiliency Model. She explains that interactions within a collective unit create a sense of community, which manifests in community action. Additionally, she offers crucial characteristics of a resilient community like a shared mentality, visionary leadership and the ability to deal with change and division (Kulig 2008). Also, Norris et al. (2008) created a Community Resilience model based on four sets of resources: Economic Development, Information and Communication, Social Capital and Community Competence. For the latter two, they chose sub-elements like social support, social embeddedness, sense of community, organizational linkages, leadership, attachment to place and Collective Efficacy. They call these elements adaptive capacities and suspect innumerable possible linkages between them (Norris et al. 2008). Likewise, Faulkner et al. (2018) understand Community Resilience as more than the sum of its parts. They define it as a process within which the capacities are drawn on in various combinations. They chose the following variables which, combined, create Community Resilience: Place attachment, leadership, community networks, community cohesion, community efficacy, and knowledge and learning. Especially notable is the research tool created in a two-year long participatory process by Cohen et al. (2013): The Conjoint Community Resilience Assessment Measurement (CCRAM). Cohen at al. (2013) identified seven variables to measure Community Resilience empirically, namely Collective Efficacy, leadership, social relationship, social trust, place attachment and preparedness (Cohen et al. 2013).

Based on this literature review six social capacity parameters are selected and explored further, aiming to cover all the aspects of Community Resilience: Visionary Leadership, Social Network, Social Support, Trust, Place Attachment and Collective Efficacy. Although the variables are a combination of all reviewed authors, this research is most similar to the selection of Faulkner et al. (2018). Most of the not incorporated factors are synonyms or sub-variables of the chosen ones. In the following sub-sections the selected variables are defined and explained.

2.3.2.1 Visionary Leadership

Visionary Leadership with to the community internal leaders is the first parameter of Community Resilience. Faulkner et al. (2018) highlight that leadership is only understood as supportive for the community's self-organization and resilience when it is legitimized from within the community. Leadership has to be generated by community needs rather than formally conferred on people outside of the community (Faulkner et al. 2018). Fabricius et al. (2007) and Stewart et al. (2009) underline that for good leadership trust for the leader needs to be established, and he or she then ideally also builds trust between the community members. Thus, internal community leaders could be traditional chiefs or pioneers who emerge because of their charisma, their formal education, international experience or new ideas (Mathie and Cunningham 2005). These visionaries drive the advancement in their communities, mobilize the social networks, organize them toward a shared vision, improve community cohesion and enable self-organization (Mathie and Cunningham 2005, Fabricius et al. 2007, Faulkner et al. 2018). The extent of Visionary Leadership in a community can be measured based on the existence of a trusted, effective leader and their ability to share a clear vision and create a trusting community (Leykin et al. 2013, Evans 2015, Faulkner et al 2018).

2.3.2.2 Social Network

Social Networks are the building blocks of communities and encompass bonding, linking and bridging ties between community members (Kirschenbaum 2004). Most scholars call those linkages social capital (Woolcock and Narayan 2000, Aldrich and Meyer 2015) but the author decides for the term Social Network. This choice is based on Lin's (2005) argumentation that social capital is not the linkage but the resources that can be accessed based on the different strengths of those linkages. Another reason for discarding the term social capital, is that it is branded as one of the five capitals of the Sustainable Livelihood Framework, often with a broader meaning, also including trust, social support, norms and access (Cohen et al. 2013, Norris et al. 2008, Mathie and Cunningham 2005). Thus, to avoid confusion, this research refers to the bonding, linking and bridging ties as Social Networks, which are defined as "networks that facilitate social co-ordination and co-operation for mutual benefit" (Putnam 1993, p. 167). Bonding social networks are characterized by homophily and are evident in the intimate, reciprocal relations between family and friends, that can be dependent on in times of stress or surviving during disasters (Woolcock and Narayan 2000, Perkins et al. 2002, Lin 2005, Aldrich and Meyer 2015). In contrast, bridging social networks span social groups and demographics and are made up of loosely connected acquaintances, who exchange resources and information to improve their social position (Lin 2005, Aldrich and Meyer 2015). Linking social networks have an even broader scale and encompass cross-cutting linkages beyond the local community, across power structures and institutional boundaries. Social Networks can be measured based on the quality and quantity of ties, as well as memberships in organizations and other local groups (Brunie 2010, Wickes et al. 2015).

2.3.2.3 Social Support

Another capacity of Community Resilience is Social Support, referring to “social interactions that provide individuals with actual assistance and embed them into a web of social relationships perceived to be loving, caring, and readily available in times of need” (Norris et al. 2008, p. 138). It can be divided in received and perceived Social Support. Received Social Support reflects actual help given and is judged most positively when reciprocal (Cohen et al. 2013, Norris et al. 2008). Perceived Social Support is defined by Norris et al. (2008) as „the belief that help would be available if needed“ (p. 138) and positively influences responses to stressors and disasters (Cohen et al. 2013). Social Support can be measured by and enacted through emotional support (emotional well-being, shared expectations), informational support (access to new information and contacts), and tangible support (task-oriented assistance) (Bridges and Sanderman 2002, Perkins et al. 2002, Grootaert 2004, Brunie 2007, Norris et al. 2008, Leykin et al. 2013, Ingelhart et al. 2014).

2.3.2.4 Trust

Trust is another capacity of Community Resilience and strengthens relationships and fosters a free exchange of resources (Samuel et al. 2014). Cacioppo et al. (2011) define Trust as “the belief that others can be relied upon and the willingness to act on the assumption of the other’s benevolence“ (p. 47). Trust emerges with group homogeneity, a shared history and from frequent interactions within close-knit networks (Schweertes Cook 2005, Samuel et al. 2014). Cacioppo et al. (2011) and Truelove et al. (2015) highlight that when people trust one another they enable cooperation, mutually beneficial actions and altruistic sharing. Communities with a high trust quotient are often attributed with “collaborative ties, reciprocity, fairness, justice, impartiality [and] leadership” (Cacioppo et al. 2011, p. 48). There are many ways to measure

trust, this research however analyses trust similarly to the World Bank (Grootaert 2004), the CCRAM (Leykin et al. 2013) and the World Values Survey (Ingelhart et al. 2014).

2.3.2.5 Place Attachment

Place Attachment, another factor of Community Resilience, stands for the emotional, cognitive and economic ties and roots people have to and in specific places (Mortreux and Barnett 2017). If Place Attachment is high, people care more for their surroundings, plan for extreme events and get more motivated to act on climate change (Perkins et al. 2002, Mortreux and Barnett 2017). Place Attachment has positive effects on caring for and improving the place, however, the attachment can also be too strong as it can lead to staying at a place regardless of high risks of for example flooding (Perkins et al. 2002, Long and Perkins 2007, Norris, Stevens, Pfefferbaum, et al. 2008, Mortreux and Barnett 2017, Faulkner et al. 2018). Murphy et al. (2012) and Leykin et al. (2013) measure Place Attachment by analysing the residents' pride about the place, their place identity and their place dependence.

2.3.2.6 Collective Efficacy

The last parameter of Community Resilience is the psychological concept of Collective Efficacy, which largely derives from Bandura's Social Cognitive Theory (1986) and originates from self-efficacy, the belief in being able to successfully manage a task. The understanding that Collective Efficacy is the aggregated version or the average of community members self-efficacies (Wang and Hu 2012) got updated over time as it ignored the group's "coordinative and interactive aspects" (Thaker 2012, p. 38). Now, the common definition of Collective Efficacy is "people's perception about their collective abilities to overcome challenges facing their group or community" (Thaker et al. 2016, p. 22). Based on Bandura (1997) there are four sources of self- and Collective Efficacy beliefs, namely vicarious experience, persuasive effect, physiological effect and mastery experience. Vicarious experience entails the learning through observing and listening to experiences of failure or success of others, who are somewhat similar (Wang and Hu 2012). The persuasive effect describes the reaction on encouragement or discouragement by trusted others. The physiology effect signifies the influence of affective states – like good or bad moods – on the belief of being able to deal with disruptive forces. Mastery experience stands for the communal experience when the community together was able to success or fail when dealing with a disaster (Wang and Hu 2012). Based on Thaker (2012) and Faulkner et al. (2018) especially positive mastery experience increases Collective Efficacy.

Bandura (2000) proclaimed that people in communities with higher perception of their Collective Efficacy are better able to manage shared resources, more likely to participate in collective action, and more enduring during setbacks. This analysis of peoples' judgments on their groups' collective capability to solve problems offers a strong theory for understanding group achievements (Ohmer 2007, Paton et al. 2008, Wickes et al. 2013). Perceived Collective Efficacy determines the strengths of organizations and influences the behaviour of what people do as and for a community and how much effort they put into it (Thaker et al. 2016). Although it has to be a coordinated effort, Thaker (2012) underlines that Collective Efficacy still operates through the individual members and varies across the group, leading to differing motivation and number of activities.

2.3.3 Associations and Interdependencies between the Parameters

This research aims to understand how the selected social capacity parameters – summarized under Community Resilience – influence Climate Change Adaptation Behaviour. As already mentioned in 2.3.2, Community Resilience is a set of interlinked social capacities which can be assembled by community members in various combinations depending on the context (Norris et al. 2008, Faulkner et al. 2018) This variability makes Community Resilience a dynamic, emergent and socially nuanced process (Faulkner et al. 2018, Rapaport et al. 2018). The capacities of Community Resilience are not static, they "evolve, strengthen, weaken, and rebound" (Norris et al. 2008, p. 144). Based on Norris et al. (2008) and Faulkner et al. (2018) those capacities can be clustered in two integrated sets, one focused on social relations – here called Sense of Community – and one focused on competence – named Collective Efficacy. How those interlinked sets of capacities interact or depend on one another is explored in the following.

The first set of factors, focused on social relations, is called Sense of Community. As a base for this research the author chooses the definition of Perkins et al. (2002), who postulate that Sense of Community is „an attitude of bonding, or mutual trust and belonging, with other members of one's group or locale" (p. 37). This study adapts Sense of Community as an umbrella term for the five social capacities Visionary Leadership, Social Network, Social Support, Trust and Place Attachment (see Figure 3).

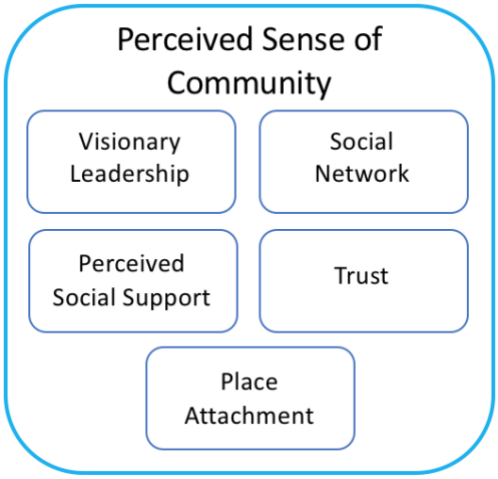


Figure 3: Perceived Sense of Community and its components (Author 2019)

Interdependencies between those five factors have been analysed by several scholars and are briefly sketched in the following. The positive association between Sense of Community and Social Support is explored by Moscardino et al. (2010) and illustrated by Truelove et al. (2015), who postulate that individuals are more open to share their scarce resources in favour of the group, when they feel a strong sense of belonging with the group. Moreno et al. (2019) show that Sense of Community and Social Support not only derive from but also create more Trust. Also, the stronger one's social connections are, the higher the chance to receive for example evacuation warnings (Norris et al. 2008). Furthermore, Paton and Johnston (2001) underline the importance of community leadership, in strengthening the mutual support, Sense of Community, Collective Efficacy and coping strategies. And Paton et al. (2001) highlight that a Sense of Community subsequently also creates attachment to the shared place and vice versa. Faulkner et al. (2018) appoint Place Attachment even with a key role and understand it as the base for the other factors to grow. This short summary of findings provides a glimpse into the complexity of the connections and the innumerable possible linkages (Norris et al. 2008).

Because of the changing nature and various interdependencies between the five variables, their relations will not be assessed in the case study but are understood as positively enforcing.

One aspect of this research is to understand and test whether and to what extent Sense of Community is a catalyst of the other main indicator of Community Resilience – Collective Efficacy – and how those two concepts influence behaviour. The relations between those three concepts have already been explored in various forms and depths. Already in 1985, Ajzen describes with his Theory of Planned Behaviour the relation between behavioural intention and behaviour within the social context (Wang and Hu 2012). Based on Ajzen's theory and on Bandura (1986) and Sampson (1997), Samuel et al. (2014) created a framework that illustrates how Sense of Community, Collective Efficacy and Behaviour are connected. They state that trusting, supportive networks are fostering Collective Efficacy. And that Collective Efficacy then, through socialization, "a process in which individuals adapt their behaviours to align with the norms of their community social network", leads to collective action (Samuel at al. 2014, p. 365). Also Paton and Johnston (2001), Long and Perkins (2007) and Wickes et al. (2015) postulate that the five parameters combined, are related to perceived Collective Efficacy and subsequently encourage community participation. Based on Zaccaro et al. (1995), Cagney and Wen (2008) and Drakulich (2014), Babcicky and Seebauer (2019) explain that social capital could represent the resource potential while Collective Efficacy represent the capacity of a community to draw on these resources for converting them into action. Likewise, Collins et al. (2014) showed that citizens' appraisals of bonding social capital (in their case shared norms, trust and reciprocity) are directly related to Collective Efficacy which together enable civic engagement. Cinner et al. (2018) link the two concepts of Sense of Community and Collective Efficacy, apply it in the context of climate change adaptation of coastal communities and also theorize that they could lead to civic engagement for adaptation addressing climate change.

2.4 Theoretical Framework and Hypotheses

The subsequent theoretical framework and five hypotheses are developed based on the cognitive approach to adaptation assessments by Grothmann and Patt (2005), combined with the concept of Community Resilience which adds a collective perspective on Climate Change Adaptation Behaviour. The most critical findings from the existing literature, that have been discussed in the preceding sub-chapters, are summarized in the following.

After a dominance of an asset-based approach towards climate change adaptation, Grothmann and Patt were able to proof in 2005 that their cognitive framework was a better predictor of adaptive behaviour than the traditional approaches. The scholars showed that a lack of appraisal of risk and self-efficacy create a cognitive barrier for taking adaptive action. The decisive role of Risk Appraisal was soon doubted, however. With their literature review of 16 empirical studies on flood adaptation, Bubeck et al. showed in 2012 that Risk Appraisal was actually not a significant determinant of adaptation action. That merely improving public knowledge of risk is insufficient, is supported by Lo et al. (2015) and Thaker (2012), who observed that social capital and the believe in the Collective Efficacy are additionally needed. Thaker (2012), based on Bandura (1997), was the first to proof the positive influence of Collective Efficacy on adaptation towards water scarcity in India. A positive relation between social capital and the intention to adapt was found by Lo et al. (2015) and Babcicky and Seebauer (2017), however they did not analyse the effect on actual adaptation action. This more holistic and communal perspective on the decision-making process regarding climate change adaptation was already postulated as a theory in the early 2000s by Paton and Johnston (2001), Adger (2003a) and Pelling and High (2005), and more recently by Cinner et al. (2018).

This literature review reflects that the concepts have been investigated separately already, and valuable results were derived. However, a combination of all the five items Collective Efficacy, Sense of Community – summarized as Community Resilience – Risk Appraisal and Climate Change Adaptation Behaviour seem to have not been empirically researched yet (Lo et al. 2015, Thaker et al. 2016, Babcicky and Seebauer 2017, 2019).

2.4.1 The Socio-Cognitive Climate Change Adaptation Framework

The Socio-Cognitive Climate Change Adaptation Framework is built on the learnings from the literature review and represents the relationship between the three concepts Community Resilience, Risk Appraisal and Adaptation Behaviour (Figure 4). The light blue box incorporates the six variables of Community Resilience, clustered in Sense of Community and the affected Collective Efficacy. When combining high Appraisal of Risk and high Appraisal of Community Resilience, they lead to Adaptation Behaviour. The assumed connections and the intensity of the correlations will be explored and tested in the case study site in Chennai, India.

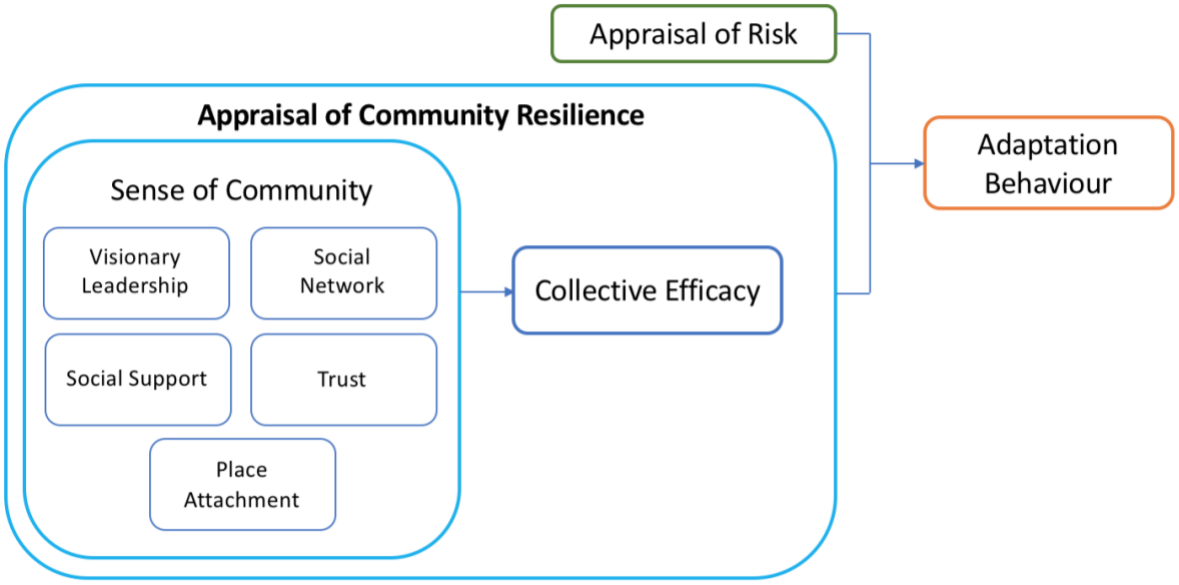


Figure 4: The Socio-Cognitive Climate Change Adaptation Framework (Author, 2019)

2.4.2 The Five Hypotheses

Based on the literature review and the theoretical framework, the following five hypotheses are derived. The first hypothesis is that Visionary Leadership, Social Network, Social Support, Trust, Place Attachment and Collective Efficacy are significant parameters of Community Resilience. The second hypothesis is that the social capacity Collective Efficacy is positively influenced by the other five factors of Community Resilience – summarized as Sense of Community. The third hypothesis is that households with stronger appraisal of Community Resilience are more likely to take adaptive actions addressing climate change effects, than households with lower Community Resilience. The fourth hypothesis is that Risks Appraisal works as a starting point for Adaptation Behaviour and has a positive influence if Community Resilience is also given. The fifth hypothesis is that the demographic control variables do not have an effect on the relationship between Community Resilience and Adaptation Behaviour.

Chapter 3: Research Design and Methods

This chapter illustrates the research design, the strategies and the methodology adopted for the field work. The study is based on a survey and additional in-depth interviews, covering randomly sampled households of the Kannagi Nagar mass relocation site in Chennai, India. The following sub-chapters elaborate first on the objective and the chosen mixed-method strategy of this research. Subsequently, the sample size, the data collection method and the operationalization are presented. Also, the validity, the reliability and the challenges and limitations of this study are discussed. The argumentation for the data analysis strategy and the description of the data preparation complete this chapter.

3.1 Research Objective and Strategy

The objective of the research at hand is to improve the understanding of how Community Resilience influences the Climate Change Adaptation Behaviour. The findings from the preceding literature review are aimed to be tested on the local scale, analysing the beliefs and perceptions of representatives of resettled households in Kannagi Nagar. First, the causal relation and effect of five social capacity parameters of Community Resilience towards its sixth factor - Collective Efficacy - are explored. Subsequently, it is analysed whether households with stronger appraisal of their Community Resilience, in combination with a high Risk Appraisal towards flooding and water scarcity, perform more adaptation actions than households with lower beliefs in their Community Resilience. The most thorough and effective strategy to accomplish this research aim is a survey that produces primary quantitative data about believes and perceptions of the residents of Kannagi Nagar. Based on Thiel (2014) a survey can best detect a causal relation between numerous variables - in this case, the parameters of Community Resilience, Risk Appraisal and Adaptation Behaviour. Also, the broad scope with a large number of units, namely the 15.000 households of Kannagi Nagar (Ramya and Peter 2014), are covered most time- and budget-effectively with a survey. Thus, to test the author's hypotheses, she spent four weeks on site, researching and collecting data. To ensure an even deeper understanding of the underlying motivations and influences, an additional eight in-depth interviews with randomly selected residents and two key-informants interviews with local urban development researchers were undertaken as supportive evidence. Thus, the research strategy is a mixed method approach, although the quantitative data is the primary aspect and the qualitative data rather an addition.As the questionnaire was standardized and filled out by a representative percentage of inhabitants of the resettlement colony, the outputs are ideally, but at least partially, generalizable (Thiel 2014). The study aimed not only make a statement about the role of socio-cognitive aspects on household Climate Change Adaptation Behaviour of the inhabitants of Kannagi Nagar, but also to add to the understanding of climate change adaptation of resettled citizens in the Global South.

3.2 Sample Size and Selection

To select a sample for this research, a random method was followed, aiming to cover the whole area of Kannagi Nagar with its 15.000 households. The target was to receive a sample of 150 confidential respondents, with the household as the unit of analysis. Questionnaires were answered by a household member older than 18 years, preferably by the household head or their spouse. For the eight in depth interviews respondents were selected randomly, although aiming for a diverse demographic mix. The two key-informants Vanessa Peter and Karen Coelho were selected as interview partners based on their year-long experience in researching the resettlement schemes in Chennai and particularly in Kannagi Nagar.

3.3 Data Collection Methods

The following steps describe the methodology to collect the needed quantitative and qualitative data. First, the hypotheses were operationalized, guided by the theoretical framework illustrated in sub-section 2.4.1. To the extent possible, the indicators for the eight variables, the questionnaire and the interviews were modelled after already tested surveys and guidelines from other scholars. Second, a pilot study was carried out with a sample of three households. Their responses were analysed, and the questionnaire was adapted accordingly to improve the wording and intelligibility of the questions. Third, data was collected in July 2019 with an interview guideline (see Appendix 2.1) and a door-to-door household survey, conducted by the researcher who was accompanied by a trained translator, who translated from and to Tamil on the spot. He or she guaranteed that the wording was clear and suitable for the use with the local population. In August 2019 the data was analysed, and findings were derived.

3.4 Operationalization of the Variables

In order to test the hypotheses, the theoretical framework and its variables were operationalized into measurable indicators. To collect quantitative data about those indicators, a household survey with 44 questions, primarily based on the Likert-scale from 1-5, with 5 as the highest value, was constructed (see Appendix 1.2). The questionnaire was clustered pertaining to the four key concepts: 1) Demographic Control Variables 2) Risk Appraisal 3) Adaptation Behaviour and 4) Community Resilience. The independent variables are Risk Appraisal and the latent variable Community Resilience, which comprises six sub-variables, the dependent variable is Adaptation Behaviour. The control variables were used to test the effect of demographics specifically on the relationship between Community Resilience and Adaptation Behaviour. All variables, indicators and questions were derived from the work of other scholars and organizations, that were evaluated in the literature review in Chapter 2. Each variable was represented by one or more indicators, with each corresponding to one or more survey questions. In the following Table 1, the operationalization and measuring method of each of the four key concepts is presented.

Operationalization of the Variables			
Key Concepts	***Variables***	***Indicators***	***Sources***
	Visionary Leadership	Existence of an effective leader	Leykin (2013), Evans (2015), Faulkner et al. (2018)
		Level of ability of leader to share clear vision	
		Level of ability of leader to create a stronger, trusting community	
		Level of respect for the leader	
	Social Network	Number and level of intimcy with family members and friends in this community	World Bank (2004), Brunie (2007, 2010), Wickes *et al.* (2015), Hagedoorn *et al.* (2019)
		Number and level of intimcy with neigbours one knows by name in this community	
		Number and level of intimcy with influential people in Chennai, that you know personally	
		Number of memberships in organizations/groups/NGOs	

Community Resilience	Social Support	Level of perceived and actually received support from the community (emotional, informative and favours)	Bridges and Sanderman (2002), Grootaert (2004), Brunie (2007), Norris et al (2008), Murphy et al. (2012) and Leykin (2013) and Ingelhart et al. (2014)
	Trust	Level of trust in community, neigbours, family and friends	Graotaert (2004), Leykin (2013), Ingelhart et al. (2014)
		Feeling of closeness in the neighbourhood	
	Place Attachement	Level of pride about the place	Murphy et al. (2012), Leykin (2013)
		Level of place Identity	
		Level of place dependence	
	Collective Efficacy	Confidence in power of community to help themselves regarding flooding and water scracity	Bandura (1997), Ingelhart et al. (2004), Krishna (2004), Leykin (2013), Thaker et al. (2016), Hagedoorn (2019)
		Household impact on community	
		Amount of communal action	
		Level of Communal Mastery Experience	
		Level of preparation and organization as a community	
Risk Appraisal	Climate Change Risk Appraisal	Level of perceived Probability of flooding and drought	Grothmann and Patt (2005), Thaker et al. (2016), Singh et al. (2018b)
		Level of perceived Severity of flooding and drought	
		Degree of change of Risk Perception and Worry	
Adaptation Behaviour	Climate Change Adaptation Behaviour	Number of adaptation action implemented towards flooding	Koerth et al. (2013), Raman and Narayan (2013), Eakin (2016), Thaker (2016), Singh (2018), Singh et al. (2016, 2018)
		Number of adaptation action implemented towards water scarcity	
		Number of general adaptation action implemented because of changing circumstances	
Control Variables	Age	Age of respondents	Brunie (2010), Thaker et al. (2016), Nhuan *et al.* (2016), Liang *et al.* (2017), Mortreux and Barnett (2017)
	Gender	Gender of respondents	
	Education	Level of eduction of respondents	
	Period since resettlement	Length of stay in Kannagi Nagar	
	Prior settlement	Location of prior settlement	
	Floor	Floor Number of Appartement	
	Size of Household	Size of Household	
	Children	Number of school-aged children in household	
	Water Source	Source of Water for Household	
	Religion	Belonging to Religion	
	Income of Household	Income-Level of Household	
	Unemployment	Number of unemployed household members 18+	
	Caste	Belonging to Caste	
	Illness	Number of ill/disabled household members	
	Marital Status	Marital Status of Household Head	
	Resettled	Resettled or Voluntarily moved	

Table 1: Operationalization of the Variables (Author 2019)

3.5 Validity and Reliability

In this research, internal validity was ensured as the indicators and questions of the survey were derived from research of other scholars, and thus are confirmed to "measure the effect they intended to measure" (Thiel 2014, p. 49). External validity, the possibility to generalize, was given as surveys are the research method with the highest external validity because of their standardization and broad scope (Thiel 2014). However, although the outputs are representative for Kannagi Nagar, they might not be fully generalizable for other resettled slums of the city or in the Global South, as the context might be too decisive (van der Linden 2015). Reliability is defined through accuracy, internal consistency and stability (Tavakol and Dennick 2011, Thiel 2014, Heale and Twycross 2015). To ensure accuracy, the variables need to be captured correctly and precisely and the distinction between the different values need to be clear (Thiel 2014). In this research, accuracy was reached as a pilot survey with three households was conducted to test for errors and clarity, and feedback was gathered from four experts from Anna University. Triangulation, the Cronbach's Alpha Test and the Exploratory and the Confirmatory Factor Analysis were the four methods used to cross-check for internal consistency, which reflect that "all the items in a test measure the same concept" and are highly interrelated with each other (Tavakol and Dennick 2011, p. 53). Triangulation was applied with the within-method, which means that multiple indices were used to measure and interpret each of the eight variables (Jick 1979). Additionally, ten qualitative in-depth interviews with residents of Kannagi Nagar and local researchers were conducted as supportive measure to understand the motivations, the underlying reasons and connections better. The Cronbach's Alpha Test, the Exploratory and the Confirmatory Factor Analysis were undertaken for the survey questions, to ensure the intercorrelation between the items (Tavakol and Dennick 2011). Stability of a study is achieved when the results of a control study at a different time, place or with a different researcher, but with the measurements under similar circumstances, would be the same (Thiel 2014, Heale and Twycross 2015). In this research that is enabled through a clear documentation, by choosing a stratified sampling of 150 households and by using survey-questions that have already been applied by other researchers in this field, which makes the outputs also comparable.

3.6 Challenges and Limitations

This survey on socio-cognitive factors faced a number of challenges and was conducted with six limitations. The first challenge that had to be taken into account when producing the questionnaire, was the lack of flexibility in changing the survey after it had been given out to the first respondents. Therefore, a pilot survey was carried out and feedback from experts was gathered to ensure a high quality and adequacy of the questionnaire. Nevertheless, after 60 respondents five more questions regarding the demographic were added, but no questions were changed. Second, a challenge for the respondents could have been difficulties in understanding the language, complicated formulations and limited time. To overcome this challenge, barriers were deconstructed through the support of a Tamil translator, clear questions, similar answer categories and a short questionnaire. The third challenge was a possible high level of interference by the researcher as the questionnaires were not filled out alone but with the researcher present and the help of the interpreter. To avoid this sociability bias, questions that would steer towards a particular reply were avoided and the hypotheses of the research were not shared. Additionally, the translator who asked the questions was trained to act neutrally. The fourth and last challenge was that a survey allows for breadth but often has a limited depth. As depth was not an aim of this study, rather a generalization, this downside was negligible. However, to still reach a better understanding and more depth, an additional two interviews

with key-informants and eight qualitative in-depth interviews were conducted with the residents of Kannagi Nagar.

Additionally, to the aforementioned challenges of the survey method, the research was conducted within the following six limitations. As this study focused on Risk Appraisal and Community Resilience, the first limitation was that several biases and errors could occur because of disruptive happenings, extreme weather conditions or influential media coverage. Therefore, a short research period of only three weeks was scheduled and all extraordinary happenings were documented transparently. And indeed, the city of Chennai faced an extreme water scarcity from June to August 2019, making the issue a very prominent and pressuring one (CNNa 2019, CNNb 2019). A second limitation was the very limited time and budget, thus the number of questionnaires was kept as low as possible, while guaranteeing a decent level of research quality and representational value to transfer insights to other problem areas. A larger sample size would have increased this study's statistical power further. The third limitation was that most questionnaires were not answered in private but with several, sometimes up to 15 people, watching and interfering. This is part of the local culture and was not feasible to be obviated fully. The fourth limitation was that the research relies on self-reported adaptation behaviour, which may not reflect the true actions objectively. However, as the aim of the study was to gather subjective data, self-reports were required by the very nature of the approach. Nevertheless, an enhancement of the measurement quality was achieved by introducing the Likert-scale and adding qualitative interviews with eight residents and two key-informants. The fifth limitation was the dependence on the translators and their interpretations of the respondents' answers. Although the assistants were trained and accompanied by the researcher, their translation was influenced by their individual backgrounds and socialisations. Especially the concepts of worry, feeling of home, being successful and organized, and confidence in working together were hard to understand for some respondents and the explanation by the four different translators could have varied, resulting in different outputs.

3.7 Data Analysis Strategy

To analyse the data a second-generation multivariate method was decided for, that allows for a concurrent analysis of all the indicators and variables instead of a consecutive one (Byrne 2016). More precisely, while a Regression Analysis in the statistical program SPSS only offers a step by step analysis of each variable separately, the add-on program AMOS enables, with the Structural Equation Modelling (SEM), a more elegant and holistic analysis, which fits perfectly to the complex theoretical framework of this research. It allows to explore the interdependencies between the exogenous, the latent, the endogenous and the control variables, simultaneously. Although most of the parameters of this research were based on a Likert-scale, not the traditional Bayesian Analysis which is used for non-continuous variables, but the Maximum Likelihood Approach was chosen for. This decision was based on Byrne's (2016) argument that it became common practice, that indicators with an ordinal scale can be treated as approximately continuous – a prerequisite for the Maximum Likelihood Approach. Furthermore, as the dependent variable of Adaptation Behaviour has a large number of categories (>4) and the data is approximate to normal distribution, the Maximum Likelihood Approach became even more acceptable (Bentler and Chou 1987, Byrne 2016). The necessary preparatory steps for this analysis were conducted in Excel and SPPS and explained in detail in Annex 3.1. Additionally to the analysis in AMOS, a few other tests and a two regression calculations were done in SPSS.

Chapter 4: Case Study, Data Analysis and Discussion

This chapter describes the case study and presents, analyses and discusses the collected data. First, the background information for the case study is introduced, including climate change impacts in Chennai and an overview of the resettlement schemes in the city. Then the creation of the variables is conducted based on quantitative analysis methods and supported by qualitative observations. To test the hypotheses presented in section 2.4.2, the quantitative data is analysed using Structural Equation Modelling. The last sub-chapter discusses the qualitative and quantitative findings and interpret the findings in relation to the theoretical framework.

4.1 Case Study: Resettled Communities in Kannagi Nagar, Chennai, India

The case study of this research is the resettlement site Kannagi Nagar in Chennai, the capital of the state Tamil Nadu in the southeast of India. This coastal city is regularly facing incidents of water scarcity and flooding which are projected to increase in frequency and extent due to global warming (Revi 2008, Jain et al. 2017). To counter future flooding disasters, the civic body that governs Chennai called Greater Chennai Corporation initiated several eco-restoration project of the Cooum and Adyar River which include the eviction of the slum dwellers residing in the river beds (Coelho and Raman 2010, Jain et al. 2017). The communities that are resettled to Kannagi Nagar, and their adaptation behaviour to water scarcity and threat of inundation are the focus of this study.

The following two sections introduce the case study of resettled communities in Kannagi Nagar within the context of the looming climate emergency. First, the contrasting effects of extreme weather events, that are intensified by climate change, are illustrated for the city of Chennai. They compile one of the main reasons for resettlements in the coastal city. Second, the history of resettlements in Chennai is summarized and the status quo presented.

4.1.1 Climate Change Impacts in Chennai: Flooding and Water Scarcity

Climate Change has detrimental effects on a global scale. However, India is known to be especially vulnerable and risk-prone (IFRC 2005, IPCC 2012), primarily in regard to water stress. The city of Chennai, in particular, is facing a multitude of hazards because of climate change. Those dangers are mainly water shortages because of absent monsoon and extreme heat; and flooding and storm surges because of more severe heavy rain and cyclones (Revi 2008, Jain et al. 2017). In combination with rapid urbanization, Chennai, with close to nine million inhabitants in its metropolitan region, depicts a very high damage risk zone for flooding and drought (Jain et al. 2017, Thaker et al. 2018). Much of Chennai's new infrastructural developments and additional resettlement colonies are built over natural drainage channel and wetlands with storage functions, whose degradation extremifies the flood disasters (Jain et al. 2017, CNNb 2019). Those swamplands provide essential ecosystem services, namely collecting and storing water during monsoon season, minimizing the risk of flooding, and working like reservoirs during dry season, feeding the groundwater table. Of the flood-prone Pallikaranai Marsh, which hosts Kannagi Nagar, only 10% percent of these natural channels and swamplands are still intact today (Coelho and Raman 2013). Additionally, the sewage, drainage and flood management systems are poorly designed and badly executed which are regarded as some of the reasons for the 2015 flooding (Revi 2008, Lavanya 2012, The Hindu 2018).

Water scarcity is also a pressing concern in Chennai. The increasing demand of the growing population in Chennai leads to a drop of groundwater levels and a drying out of local rain-fed

reservoirs (Jain et al. 2017). Especially the poorer citizens, who do not have private wells, have to buy expensive water in cans or from public standpipes, communal wells and water trucks (Thaker 2012, Srinivasan et al. 2013, CNNb 2019). During the data collection for this research, Chennai suffered from an extreme water scarcity, which was especially strenuous to the livelihoods of slum dwellers and resettled communities who were dependent on lorries organized by the Greater Chennai Corporation or expensive water cans (CNNa 2019, CNNb 2019). Households who cannot afford those have to survive with the often brackish and scarce metro water (CNNb, 2019). The steps by the Indian government to secure a clean water supply in the last years were regulating the price for water, water recycling and desalination (Thaker 2012, Jain et al. 2017, Peter 2017). Also, rainwater harvesting has been promoted and has shown positive effects (Eco Business, 2108). Concluding, Chennai suffers from too much and not enough water, both extremes intensified by urbanization and climate change. Especially the poorest citizens face the hardest challenges as they are dependent on costly water lorries and face resettlement from riverbeds to vulnerable, flood-prone marshlands (Coelho and Raman 2010, CNNa 2019).

4.1.2 Resettlement Schemes in Chennai

Relocations of informal settlements have a long history in Chennai, with a key moment in 1971 when the Tamil Nadu Slum Clearance Board (TNSCB) was founded, under the Tamil Nadu Slum Areas (Improvement and Clearance) Act from 1970 (Jain et al. 2017). The Act and the TNSCB were created to safeguard informal settlers from arbitrary displacements and to provide security of housing rights and enhancement of livelihoods. The slum-clearance initiatives changed over time from in-situ upgrading, over multi-storied tenement constructions to mass-scale displacements of slum dwellers to urban peripheries. The latter got triggered by high real estate prices, the opportunity of receiving attractive funding-schemes for climate change adaptation projects and the new priority on river eco-restoration and city beautification projects (Coelho 2017, Jain et al. 2017).

The rivers Cooum and Adyar, which cut through the centre of Chennai, are two of those restoration sites (Coelho and Raman 2010). The first improvement project was launched in 1967 because of the Cooum's sewage-laden, stagnant waters (Coelho and Raman 2010). After the tsunami and an extreme flooding happened in 2004 and 2015, several more large-scale relocations of slums from river plains were undertaken (Peter 2017). In total more than 50.000 families, which amounts to 300.000 individuals, have been and are still displaced from the riverbanks for the various resettlement projects in Chennai (Ramya and Peter 2014, Peter 2017). The Greater Chennai Corporation aims to move the encroachments from the stream beds to provide safety, and post-flood rehabilitation, ensure adaptation to future extreme weather events and allow river upgrading (Coelho and Raman 2013, Peter 2017). A growing urban middle class is in support of these efforts, hoping that the creation of parks ensures aesthetic appeal and utility (Coelho and Raman 2010, Kundu 2013). Also, a construction of a 19-km elevated expressway is planned in this area and several office buildings, multi-story luxury complexes and five-star hotels have been approved, with doubtful environmental effects (Coelho and Raman 2010). Although policies instruct for in-situ slum upgrading, most funds are spent on building resettlement tenements in urban peripheries (Jain et al. 2017). Many scholars, media and experts criticise those projects for having contradicting effects and hidden intents (Coelho and Raman 2013). They see it as a proof that waterfront development and eco-restoration under the label of climate change adaptation are rather a strategy of capital accumulation through real estate value, for making the city attractive to global business and for removing the slums out of sight to the peripheries (Coelho and Raman 2010, Coelho and Raman 2013, Kundu 2013, Peter 2014).

Although the schemes are implemented as a flood-adaptation strategy, people get resettled from to-be restored waterbodies onto other waterbodies, debunking the government's strategy Coelho and Raman 2010, Jain et al. 2017). Building on those wetlands in the outskirts of the city heightens the risk for flooding in whole of Chennai. It leads to the intensification of flooding of the city because of a loss of buffer and aquifer recharge area (Coelho and Raman 2010, Jain et al. 2017). Also, the resettled slum dwellers are still highly exposed to floods in those former marshes, that are low-lying and natural basins in times of heavy monsoon rains. The threat of inundation is further accentuated because of shortages in infrastructure and blocked drainage for water in the resettlement sites (Jain et al. 2017).

The mass relocation colony of Kannagi Nagar is located on the low-lying wetland of Pallikaranai Marsh, around 15-20km south from the original places of habitation (Coelho and Raman 2010, Ramya and Peter 2014, Jain et al. 2017). Kannagi Nagar is one of the largest resettlement sites in India and was built in a phased manner from the year early 1990s and is still under expansion and construction (Ramya and Peter 2014). More than 15.000 tenements have been constructed by the TNSCB in Kannagi Nagar (Ramya and Peter 2014, Peter 2017). The conditions for the already income-poor evicted communities did not improve in the resettlement colony, their livelihoods rather deteriorated further (Coelho and Raman 2010, Jain et al. 2017). The resettlement process disrupted communities and mixed different castes, religions and relocation backgrounds within the same neighbourhood (Cernea 1997, World Bank 2004, Wolf et al. 2013, Engle et al. 2014, Peter 2017). Even after living together for several years on the same site, many communities have not found back together or could create new social bonds (Jain et al. 2017). Moreover, many lost their job and dropped out of school because of the too long travel distances (IPCC 2001, Ramya and Peter 2014). Negative prejudices about workers from resettled areas keep them from finding new jobs in the city, and the resettlement site does not offer enough opportunities and amenities itself (Ramya and Peter 2014). Also in times of disasters like flooding, the distance from the city centre of the resettlement colony constrains the fast distribution of relief help and makes them the last to be reached (Coelho and Ramen 2013, Jain et al. 2017). Residents further report a lack of schools and health facilities, broken sewage systems and dirty water pipes. In the last decades however, the inhabitants were able to reach quite some improvements of the amenities of Kannagi Nagar (Coelho and Ramen 2013). Through demonstrations, petitions and media stories they were able to establish schools, get metro water access, electricity, garbage collection and health care services for their community (Coelho and Ramen 2013).

4.2 Data Analysis

To analyse the collected data, several steps are needed. First, the demographics of the 150 survey-respondents is presented to get an impression of the sample. Then, built on the quantitative data and the additional eight in-depth interviews with residents and two more interviews with the key-informants Karen Coelho and Vanessa Peter, the variables are created. The final indicators are selected based on the Exploratory and the Confirmatory Factor Analysis, the Cronbach Alpha test and the qualitative observations. After also some parametric tests are run, the hypotheses are tested with a Structural Equation Model in AMOS and a regression analysis in SPSS.

4.2.1 Data on Demographics

The number of respondents of the face-to-face household survey amounts to n=150, including only permanent residents of the case study site Kannagi Nagar. Every area of the resettlement

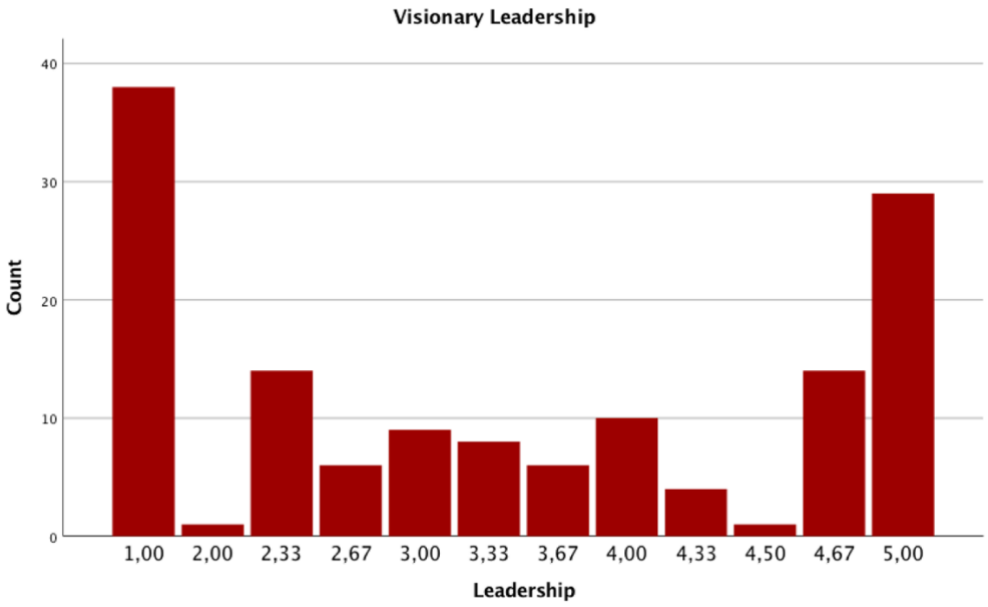
location was covered, to include possible variations in infrastructure and access to amenities within the relocation colony, while similar environmental and political challenges are ensured. More details and a visualization of the demographics can be derived from the Graphs 8 to 15 in Annex 3.2. Of the 150 respondents 63% were women while 37% were men. This disparity is explained by the fact that more women were following duties at home while men rather worked outside of the resettlement site and were more difficult to access. The men who were interviewed were mostly unemployed or dependent on day-labour. The age distribution, on the other hand, is rather balanced with between 20% and 27% of respondents per age group. The Education Level is low but quite varied, with a third of people having finished only Secondary School, while 15% and 18% of respondents have finished only Primary School and Higher Secondary, respectively. 16% of respondents have no formal education at all. Less than 10% of respondents have an Undergraduate or a Post-graduate degree. The residents were evicted from a number of different districts in Chennai, over 50 different ones were covered in the survey. The majority of respondents are coming from Mylapore, Reserve Bank and Santhome, all areas that were highly affected by the tsunami in 2004. This also explains why most respondents are living in Kannagi Nagar already for over 15 years (>65%), having been resettled after the tsunami or even before. Not even 20% were resettled or moved to Kannagi Nagar less than 10 years ago. This shows that most of the residents had time to (re-)create connections to the place and the people. Surprisingly, one third of all respondents were not resettled to Kannagi Nagar but moved there because of economic pressure. The growing number of citizens moving to Kannagi Nagar for affordable rents is explained by Coelho et al. (2013), who describes the situation as a "de factor low-income housing market, filling the gap in direct state or market provision for this segment" (p. 41), which attracts the urban poor. Analysing the family structures, more than two thirds of respondents live in families of four to five members in the two-room apartments and have a very low income. The level of income per household varies between 4.000 rupees per month and more than 20.000 rupees per month. The income level with most respondents (26%) is between 8000 and 12.000 rupees per month. None of the respondents was part of the Forward Caste, more than half (56%) were part of the lowest caste Scheduled Caste/Scheduled Tribe, while the other 43% are counted as Backward and Most Backward Castes.

4.2.2 Creation of the Variables

Guided by the theoretical framework, the dependent variable Sum of All Adaptation Actions is created, as well as the independent variables Risk Appraisal and the six parameters of Community Resilience: Visionary Leadership, Social Network, Trust, Social Support, Place Attachment and Collective Efficacy. To compute those variables, three types of Analysis are conducted parallelly: the Exploratory Factor Analysis (EFA), the Confirmatory Factor Analysis (CFA) and the Cronbach Alpha test. The EFA is run in order to group the indicators based on their strong correlations, without applying the a priori theory. This helps to adjust the theoretical framework to the actual correlations and create a base for a clean SEM analysis. Also, a Cronbach Alpha reliability analysis is carried out to test the compatibility of the indicators and show that they measure the variable in a consistent way. Thirdly, the Confirmatory Factor Analysis is conducted in AMOS to validate the adjusted variables within the Structural Equation Model. Additionally, the qualitative data from the ten interviews are used as support to justify the decisions. The outputs of the interviews are not analysed separately, but broadly integrated in the Discussion (Chapter 4.3). The following paragraphs show how the variables are created, the Figures 11 and 12 in Annex 3.3 illustrate this transformation graphically, and the descriptive statistics of the new variables can be found in Table 6 in Annex 3.3.

Visionary Leadership

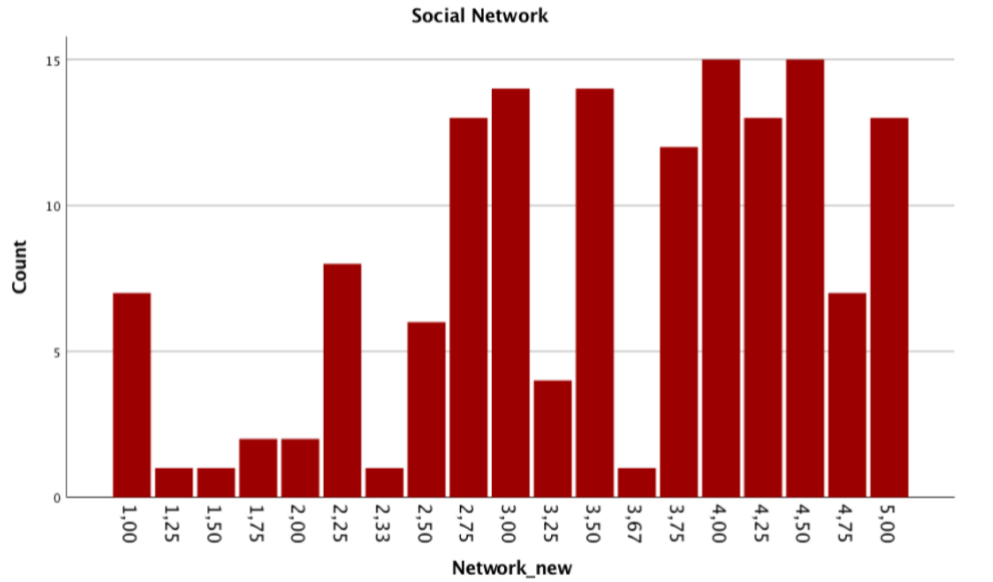
To calculate the variable of Visionary Leadership the three indicators of Vision Creation, Trust Creation and Respect are used (Graphs 16 to 18 in Annex 3.3). Before working with them, the Likert-Scale 0 to 5, with 0 standing for "No Leader", has to be transformed to 1 to 5 by using the recoding function in SPSS for each of the three variables (Figure 13 in Annex 3.3). The Cronbach Alpha of the three recoded indicators is p=0.934, which is shows that they are measuring quite similar aspects of the concepts. Also, the EFA and the CFA confirm that those three indicators clearly and strongly load on the same variable. The measurement is consistent; thus, the indicators can be merged to the new semi-continuous variable Visionary Leadership (Graph 1).



Graph 1: Visionary Leadership (Author 2019)

Social Network

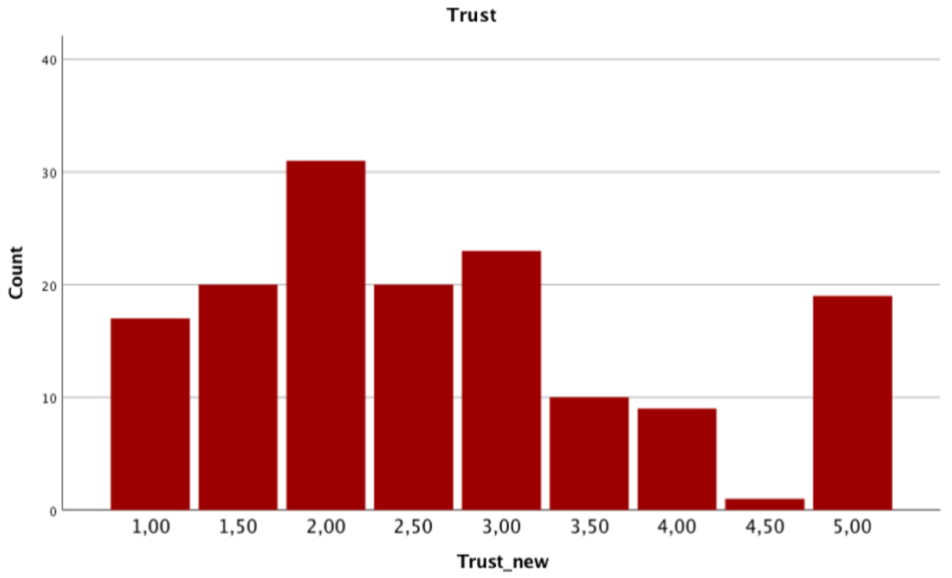
To calculate the variable of Social Network the six indicators Number and Intimacy of Connections with Family, Neighbours and Influential People are used (Graph 19 to 24 Annex 3.3). Originally, the number of Memberships in Organizations was planned to be included, but because of a difference in scale and a lower Cronbach Alpha (p=0.689), this indicator was excluded from further calculations. Respondents were the closest with people from their block or street (Interview partners 5, 6, 7 and 8) and the other people they were resettled with (Interview partners 2, 3). This is also reflected in the quantitative data and in the judgement of the key-informant Karen Coelho (Coelho 2019) who diagnoses a "lot of micro-neighbourhoods" within which "people are maybe quite connected" but the general impression is a "quite fragmented" community. Although the Cronbach Alpha of those six indicators is p=0.714, in the EFA the two indicators Connections and Intimacy with Influential People both group towards a separate variable. This is also in accordance with the experience in the field, that the vast majority of people did not know influential people very closely. Thus, those two indicators are not included in the newly created semi-continuous variable Social Network (Graph 2), even though the Cronbach Alpha decreases to p=0.635 and the CFA shows some loadings less than 0.45.



Graph 2: Social Network (Author 2019)

Trust

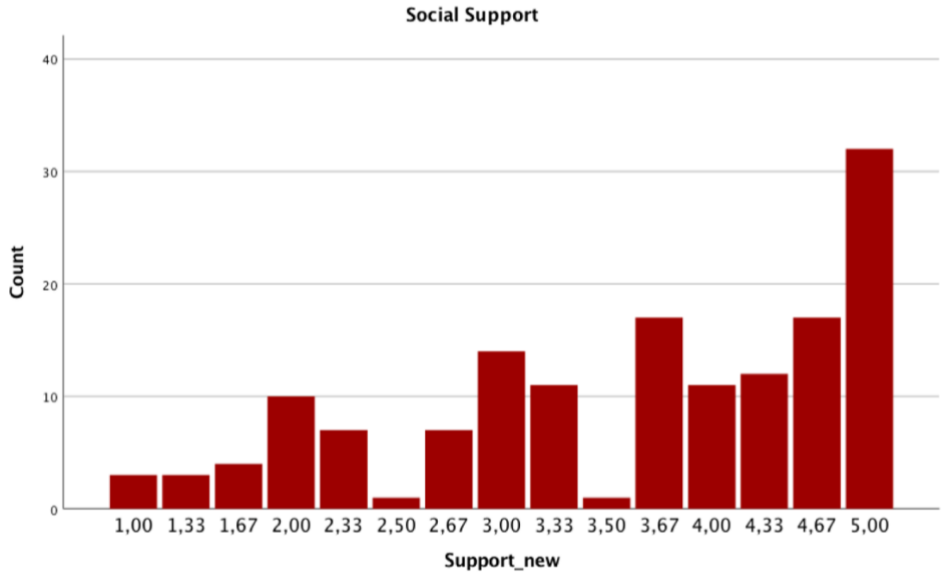
To calculate the variable of Trust, the four indicators Trust in Family and Friends, Trust in Neighbours, Trust in Community and Feeling of Closeness are used (Graph 25 to 28 Annex 3.3). The Cronbach Alpha of those four indicators is p=0.682. When excluding the indicators Trust in Family and Feeling of Closeness, who in the EFA do not load on the same variable, the Cronbach Alpha increases to 0.788. The indicator Trust in Family instead loads on the variable Social Network, probably because the trust-indicator also reflects the closeness to the family. The indicator Feeling of Closeness loads on Place Attachment, explainable as the respondents connect the place with people and would be sorry to leave their neighbours. This is also reflected in the interviews, where respondents say "I'd be very sorry to leave Kannagi Nagar as I have become attached to the neighbours" (Interview partner 8). However, when moving both indicator to the variables they load on, they reduce the Cronbach Alphas, and furthermore the indicator Closeness is a Heywood case that hinders further calculations in AMOS. Thus, both indicators are eliminated from the dataset. Although the indicators of Trust then decrease to only two, they are loading strongly in the CFA and are merged (Graph 3).



Graph 3: Trust (Author 2019)

Social Support

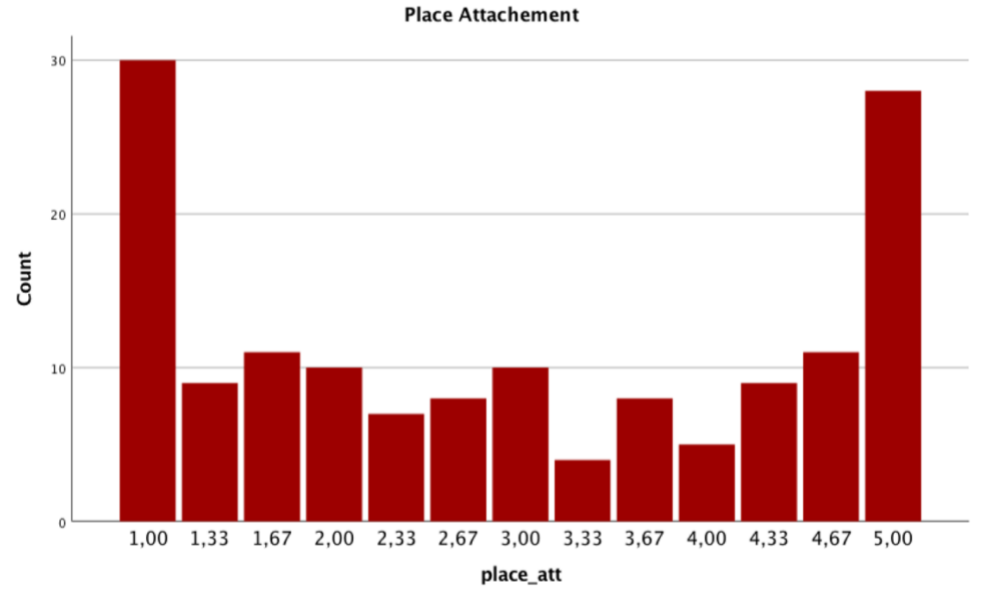
To calculate the variable of Social Support the four indicators Perceived Support and Frequency of Favours, Emotional Support and Information Shared are used (Graph 29 to 32 in Annex 3.3). The indicator Frequency of Information Shared is deleted because it does not load on the same variable in the EFA. The indicator Perceived Support is kept although it neither loads on the same variable, and has a comparably low loading in the CFA, but keeping it makes the EFA more significant. As the Cronbach Alpha of those three indicators is p=0.781, the indicators are measuring the variable in a consistent way and can be merged to the new semi-continuous variable Social Support (Graph 4).



Graph 4: Social Support (Author 2019)

Place Attachment

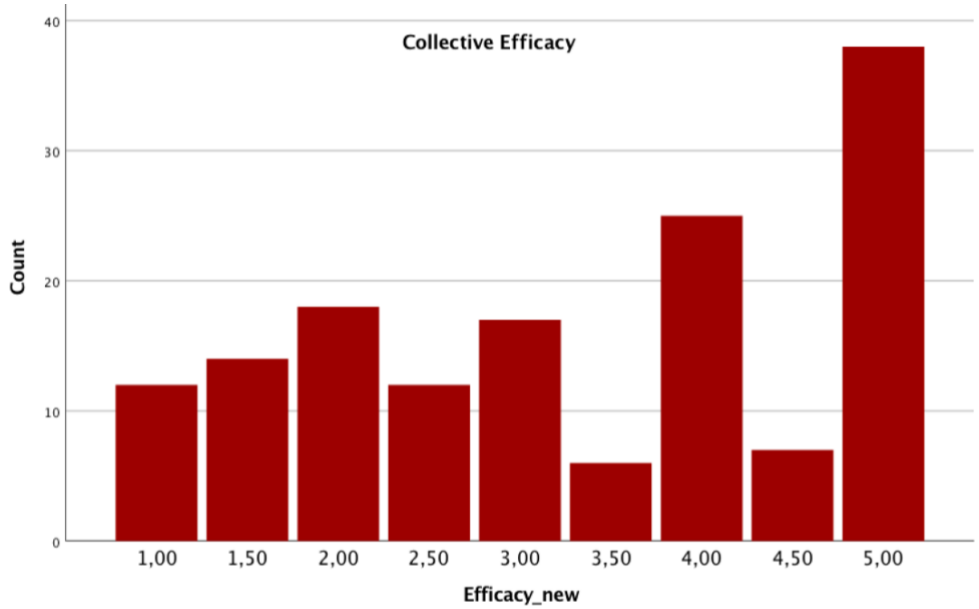
To calculate the variable of Place Attachment the three indicators of Level of Pride about the Place, Level of Place Dependence and Level of Place Identity are used (Graph 33 to 35 in Annex 3.3). As the Cronbach Alpha of those three indicators is p=0.864, and the loadings in the EFA and the CFA are equally strong, the indicators are merged to the new semi-continuous variable Place Attachment (Graph 5).



Graph 5: Place Attachment (Author 2019)

Collective Efficacy

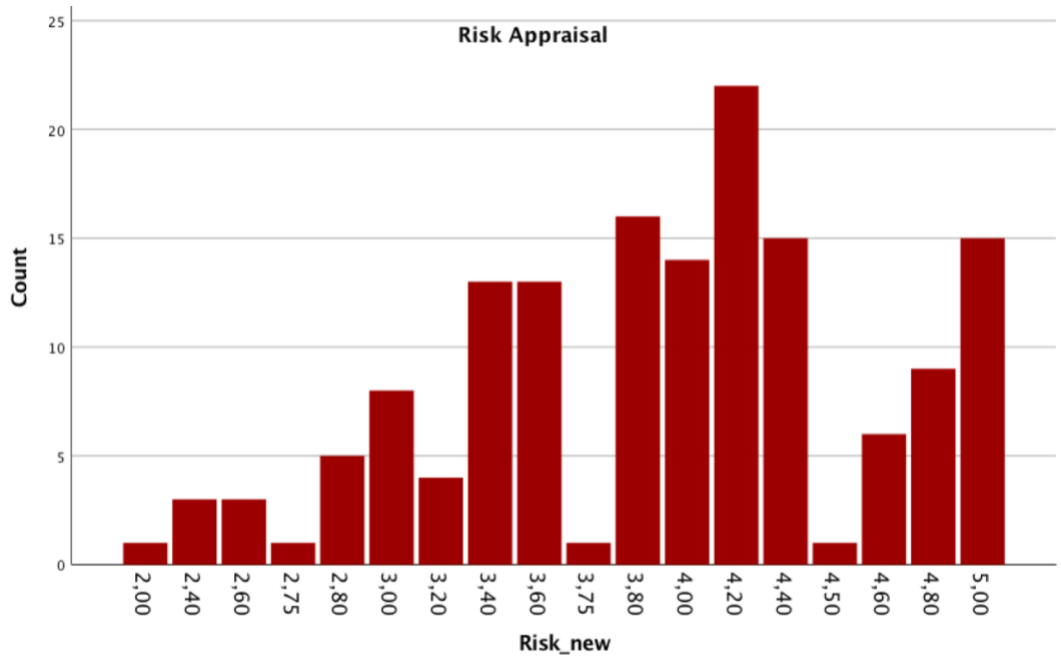
To calculate the variable of Collective Efficacy the six indicators of Confidence in Collective Efficacy regarding Flooding and Water Scarcity, Level of Influence, Communal Action, Master Experience and Level of Preparedness are used (Graph 36 to 41 in Annex 3.3). However, in the EFA the four indicators Level of Influence, Communal Action, Master Experience and Level of Preparedness do not load with the other two indicators. Also, the original Cronbach alpha of p=0.708 increases to p=0.777 after those four indicators are deleted. This lack of clarity is also reflected in practice as the questions regarding those four indicators seemed to be very hard to grasp for the people during the interviews, as mentioned in sub-chapter 3.6. Thus, only the two indicators of Confidence in Collective Efficacy regarding water scarcity and flooding seem to be reliable. As the variable regarding flooding is disproportionally strong in the CFA and has to be constrained to 1. Then, those two variables are merged to the new semi-continuous variable Collective Efficacy (Graph 6).



Graph 6: Collective Efficacy (Author 2019)

Risk Appraisal

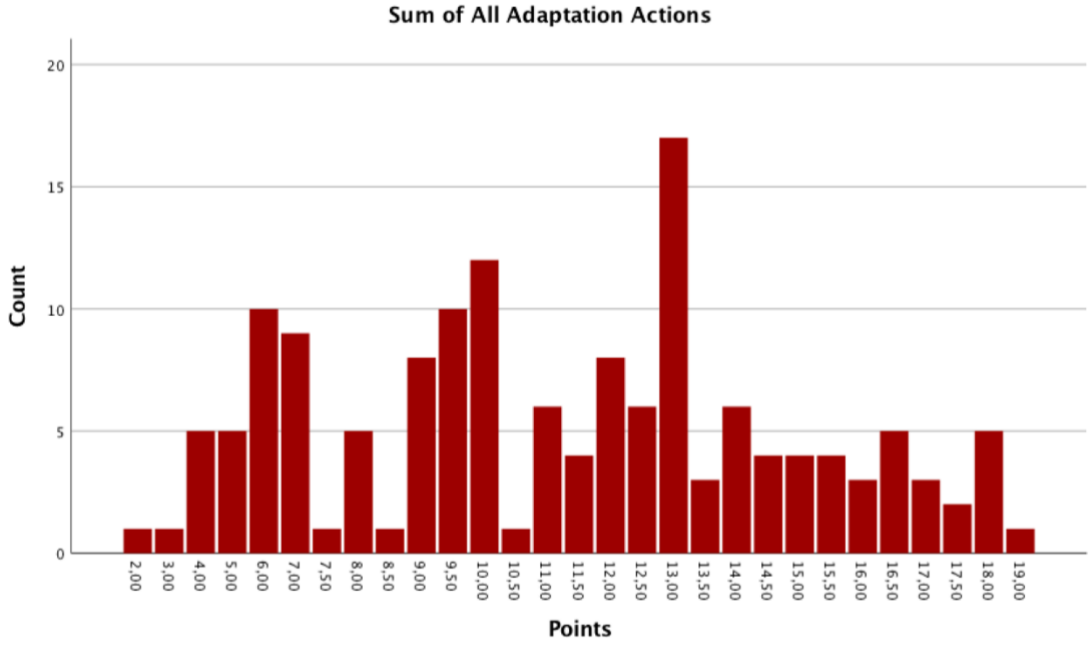
To calculate the variable of Risk Appraisal the six indicators of Probability, Severity and Change of Risk Perception regarding Water Scarcity and Flooding, respectively, are used (Graph 42 to 47 in Annex 3.3). The item Worry about Flooding is deleted as it does not load to any variable. The probable reason for this is that people have too many more pressing challenges to worry about than a potential flood in the future, especially in times of acute water scarcity. This is illustrated by quotes from respondent number 60 "I do not worry about flooding because we do not even have enough rain", respondent number 99 "Flooding is unpredictable. I am not the weather forecast.", as well as the interview partners number 3 and 7 who both say that they cannot take any precautions for flooding before the disaster strikes (see Annex 2.2). Also, the key informant Vanessa Peter summarizes this phenomenon: "Their life is full of struggle, they don't have time to think about any of these things" (Peter 2019). The other two risk items regarding flooding neither load onto the variable, after deleting the indicator Worry about Flooding, but are kept in order to still represent a broad range of Risk Appraisal towards water scarcity and flooding. The loadings of the other indicators are rather low in the EFA and the CFA and also the Cronbach Alpha of the five indicators just reaches the 0.6 threshold with a p=0.604. Nevertheless, the five indicators are still reliable enough to be merged to the new semi-continuous variable Risk Appraisal (Graph 7).



Graph 7: Risk Appraisal (Author 2019)

Adaptation Behaviour

As the variables on actions tackling flooding and water scarcity and general adaptation actions were transformed into points, the variables are of continuous scales and no Cronbach Alpha has to be calculated (see Graph 48 to 50 in Annex 3.3). Rather, the sum of all points of the three variables is calculated and the new variable Sum of All Adaptation Actions is created (Graph 8). In the CFA the loadings of all three variables is are rather low. In the EFA general adaptation and water scarcity adaptation load with the variable Social Network, which is ignored as they clearly do not measure the same concept. The variable Flooding Adaptation does not load on the same variable as water scarcity, which is logical, as they represent a very broad range of adaptation actions. For this study a holistic picture on climate change adaptation is thought for, thus all three items are kept and merged.



Graph 8: Sum of All Adaptation Actions (Author 2019)

4.2.3 Testing the Hypotheses

Before constructing the SEM and testing the hypotheses, a few tests have to be run with the newly created variables for the EFA, the CFA and to validate the parametric assumptions. The EFA is acceptable based on the goodness of fit test, the discriminant validity test and a clean pattern matrix output (see Appendix 3.4). The model fit, the validity and reliability test and the common method bias test are conducted for the CFA and the results are also sufficient (see Appendix 3.4). In order to also conduct the parametric Pearson's Correlation Test and a Regression Analysis in SPSS, the following assumptions and requirements were tested for and are all met (Field 2009, see Appendix 3.4): Normality Assumption, Homoscedasticity, Linearity, Multicollinearity, Autocorrelation, (Semi)-Continuous Variables, No Outliers and Linearity Paired Observation. Thence, the following Structural Equation Model (V3), based on the theoretical framework presented in section 2.4.1, is built with the newly created variables and the additional latent variable Community Resilience (Figure 5).

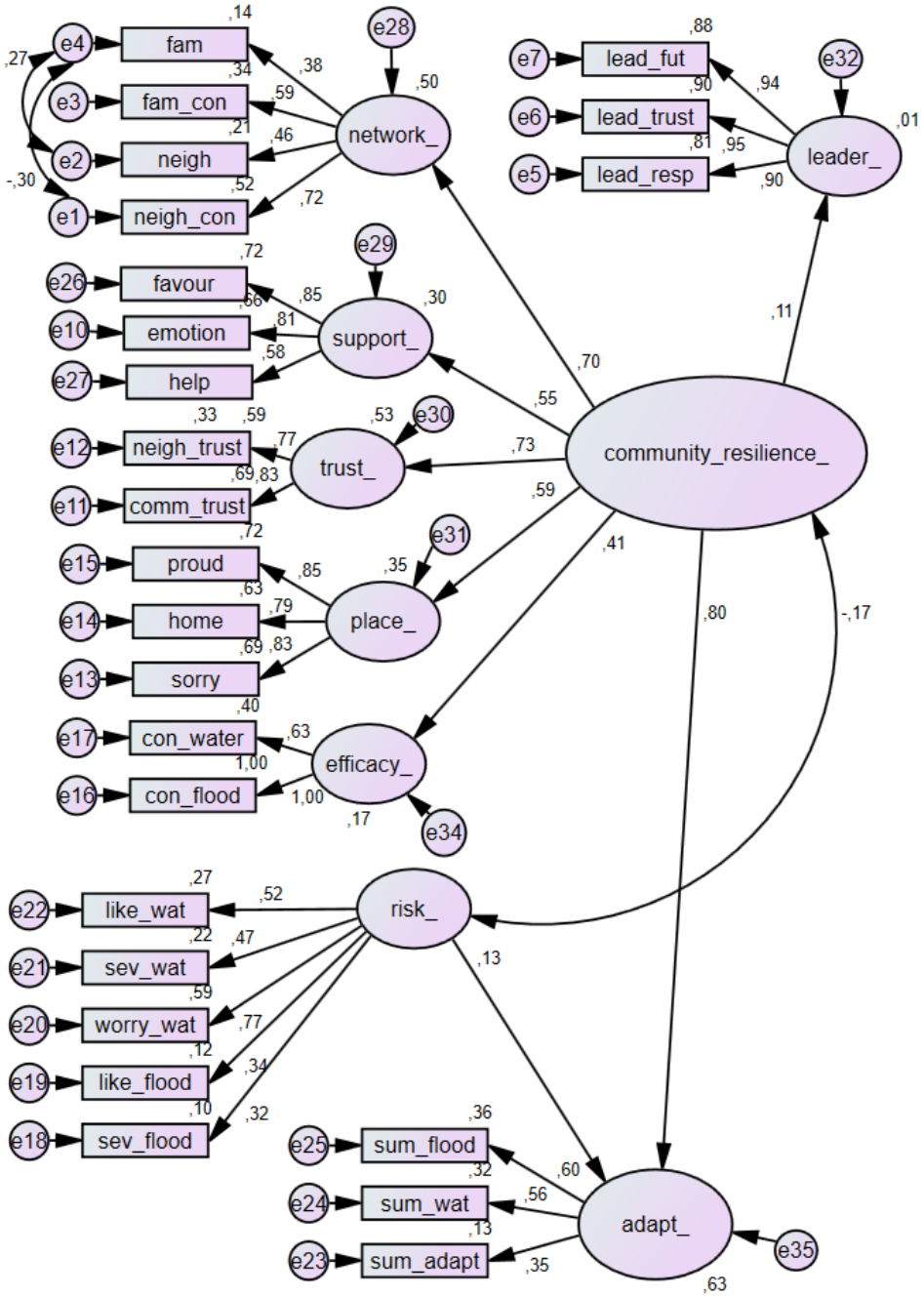


Figure 5: SEM (V3) for Community Resilience towards Adaptation Behaviour (Author 2019)

The Figure 5 shows the standardized regression weights, the error term weights and the covariances between the variables. For simplification reasons, the five parameters are not summarized under Sense of Community as in the theoretical framework, but lead directly to Community Resilience, together with the sixth factor Collective Efficacy. Table 2 shows the Model Fit with acceptable outcomes for V3 as the final model, V4 as the transformed and imputed model to analyse the influence of Sense of Community on Collective Efficacy, and V5 as an additional model that includes the interaction variable resi_risk. The thresholds are based on Hu and Bentler (1999).

Measure	V1_start	V2_control	V3_no control	V4_imputed	V5_interaction	Threshold
Cmin/df	1.481	1,458	1.522	1.031	1,468	< 3
CFI	0.916	0.876	0.902	0.999	0.868	>0.95 perfect >0.9 traditional
GFI	0.848	0.811	0.833	0.991	0.809	>0.95
AGFI	0.800	0.762	0.795	0.922	0.757	>0.80
RMSEA	0.056	0.055	0.058	0.014	0.055	<0.05 perfect 0.05-0.1 moderate
PCLOSE	0.208	0.213	0.120	0.664	0.175	>0.05

Table 2: Model Fit Table for CFAs (Author 2019)

The Standardized Regression Weights Table 3 shows the strength of influence (Standardized Regression Weight) and the significance (p-value), respectively.

Independent Variable	Dependent Variable	Standardized Regression Weight β	p-value
Social Network	Community Resilience	0.704	***
Social Support	Community Resilience	0.545	***
Trust	Community Resilience	0.730	***
Place Attachment	Community Resilience	0.592	***
Collective Efficacy	Community Resilience	0.411	***
Visionary Leadership	Community Resilience	0.111	0.246
Community Resilience	Adaptation Behaviour	0.804	***
Risk Appraisal	Adaptation Behaviour	0.128	0.329

Table 3: Standardized Regression Weights and p-Value Table without Control Variables (Author 2019)

In the following, the Table 3, which presents the outputs of the SEM in AMOS, is analysed and interpreted in relation to the five hypotheses presented in section 2.4.2.

H1: The six parameters create Community Resilience.

Five of the six parameters show evidence to have a positive effect on the latent variable Community Resilience. The effect of Trust (β=0.730***), Social Network (β=0.704***) and Place Attachment (β=0.592***) are the highest, followed by Social Support (β=0.545***) and Collective Efficacy (β=0.411***). This is in line with the expectations and supports the first hypothesis. Only Visionary Leadership has no significant effect with β=0.111 and p>0.1. This

outcome is also confirmed by the correlation analysis in SPSS that shows significant positive correlations on the 0.01 significance-level between all variables of Community Resilience, apart from Visionary Leadership which has no correlation with any of the other variables and Social Network which shows no correlation with Collective Efficacy (Table 9 in Annex 3.5). Also, the Cronbach Alpha without the variable Visionary Leadership (p=0.651) is higher than when including it (p=0.591). This discrepancy could be attributed to the fact that most people reported the ex-councillor TC Karuna as a leader, although they see him rather as a top-down politician and service provider than a bottom-up leader who is strongly intertwined with the local community (see Annex 2.2). This missing characteristic of mobilizing the social networks and enabling self-organization makes TC Karuna and the Visionary Leadership variable rather an external influence than an integral part of the concept of Community Resilience.

H2: Collective Efficacy is positively influenced by Sense of Community.

A second model (see V4_imputed in Table 2) is created to test how the two sets of Community Resilience are interacting (Figure 6). The first set which is identified as Sense of Community is focused on social relations and incorporates the first five parameters; the second one is focused on competence and is represented by Collective Efficacy. The five variables are imputed and the new variable Sense of Community is created and also imputed. The SEM shows, that Sense of Community has a significant positive effect on Collective Efficacy (β=0.355***).

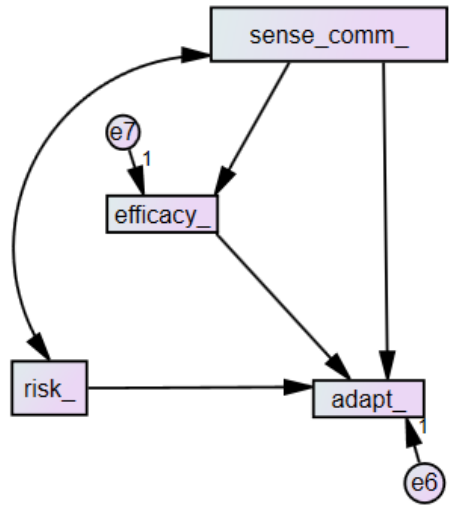


Figure 6: SEM for the Interaction between Sense of Community and Collective Efficacy (Author 2019)

Also a simple linear regression analysis in SPSS shows a significant effect (see Table 10 in Appendix 3.5). The Prediction Equation for Sense of Community and Collective Efficacy is y= 1.83 + 0.46x, which is illustrated in Figure 7 with the best fit line. The β results in 0.285 with a p=0.000 and an R-square of 0.081, indicating that 8% of the change in Collective Efficacy can be explained through a change in Sense of Community. These result shows that when people are more connected, feel more trust towards the community, receive and perceive social support and are attached to the place they live – they also feel more empowered and self-confident to help one other. Because of the dynamic nature and the innumerable possible linkages between the five factors, their relations will not be assessed in further detail.

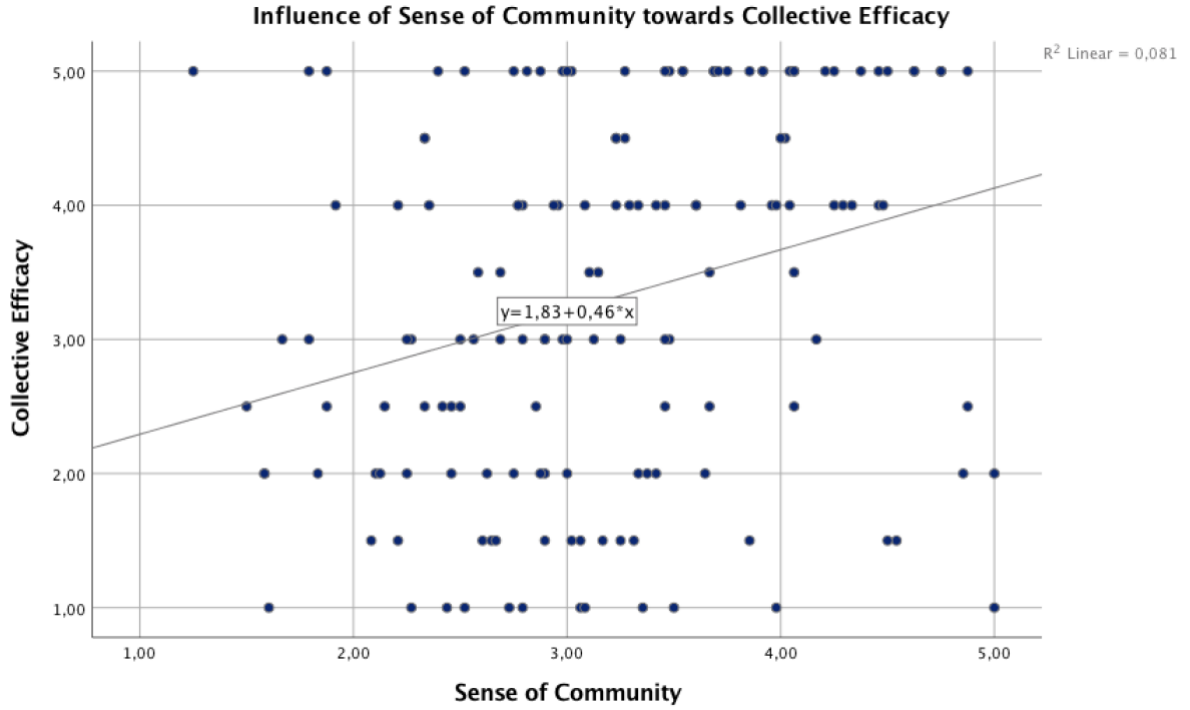


Figure 7: Influence of Sense of Community towards Collective Efficacy (Author 2019)

H3: Community Resilience influences Adaptation Behaviour positively.

As can be further drawn from the analysis in AMOS and Table 3, the dependent variable Adaptation Behaviour is significantly and positively influenced by Community Resilience (β=0.804***), which validates the third hypothesis. Their relationship is also illustrated in the following Figure 8 with the best fit line:

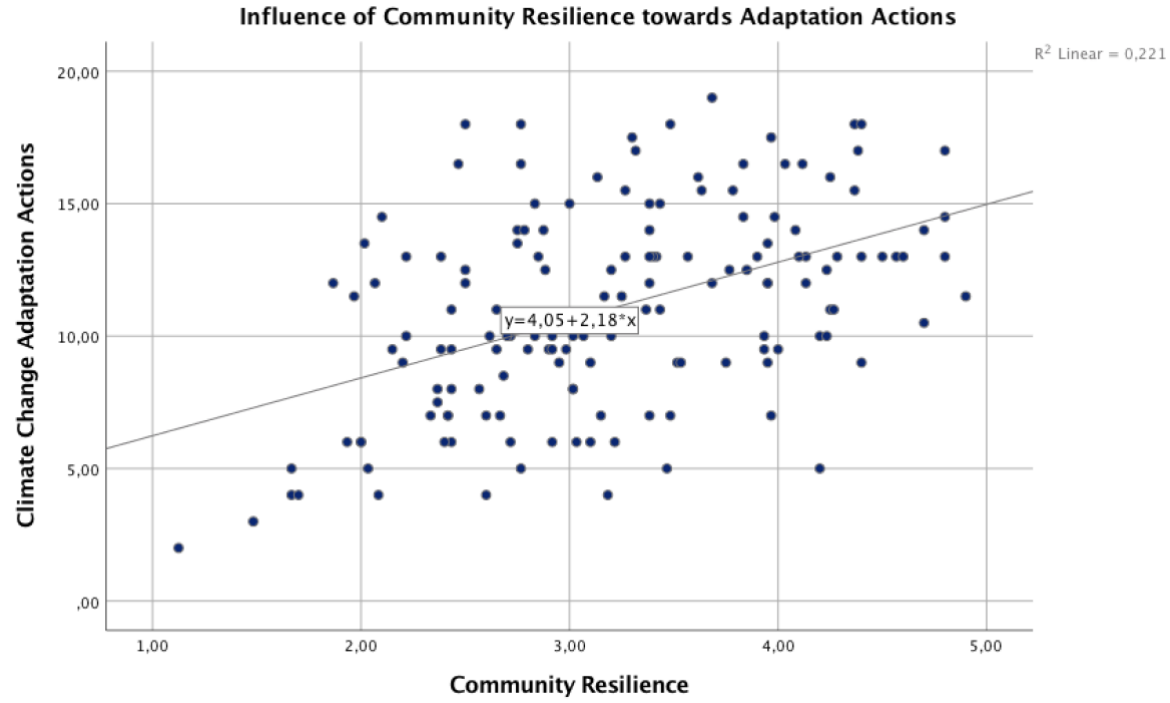


Figure 8: Influence of Community Resilience towards Adaptation Behaviour (Author 2019)

Deriving from SPSS, the Prediction Equation for Community Resilience and Adaptation Actions is y= 4.05 + 2.18x, with a β of 0.470 and p=0.000 and a R square of 0.221, indicating that 22% of the change in Adaptation Actions can be explained through a change in Community Resilience (see Table 11 in Appendix 3.5). This finding upholds that not only Collective Efficacy alone but rather the broader concept of Community Resilience has a strong positive effect on the climate change adaptation actions taken by the households of Kannagi Nagar. Not only the confidence in the efficacy of the community but also the support network, the provided help and emotional investment into the place play a crucial role in building adaptive capacity.

H4: Community Resilience and Risk Appraisal in combination influence Adaptation Behaviour positively.

The hypothesis four is tested by creating a new model in AMOS. The data is imputed and a new variable as a product of Community Resilience and Risk Appraisal, called resil_risk, is computed and added to the model (see V5_interaction in Table 2 and Figure 17 in Annex 3.5). The output shows, that while Risk Appraisal alone has no significant relationship with Adaptation Behaviour (β=0.128, p>0.1), but as a moderator variable Risk Appraisal does strengthen the positive relationship between Community Resilience and Adaptation Behaviour (β=0.186, p=0.094*), which is also illustrated in following Figure 9:

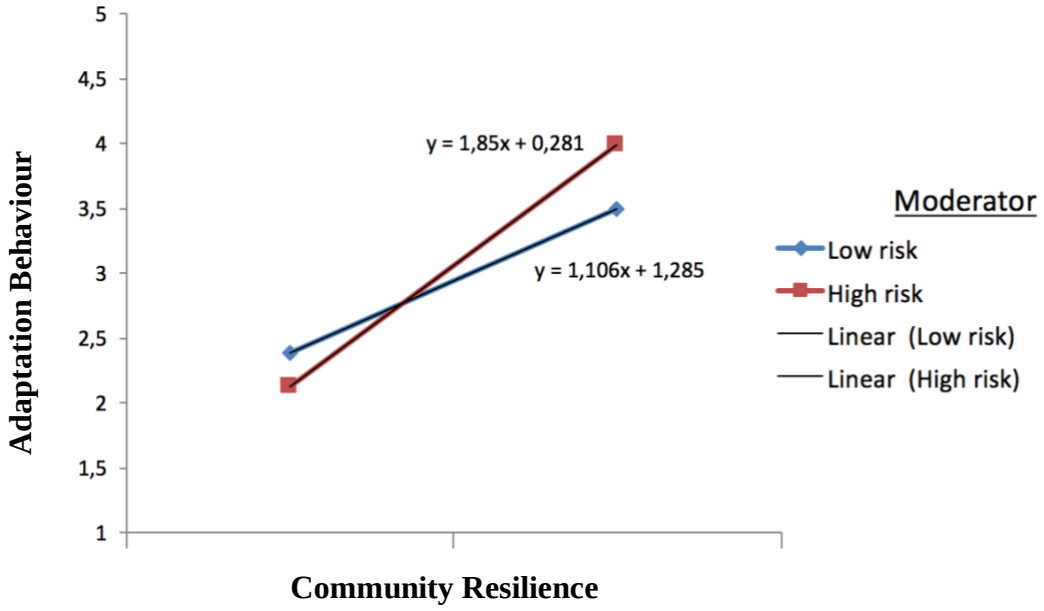


Figure 9: Moderating Effect of Risk Appraisal on the Role of Community Resilience (Author 2019)

This outcome shows that if the Risk Appraisal is higher, also the Community Resilience influences Adaptation Behaviour stronger. Concluding, focusing on creating awareness of possible climate change risks has no effect on adaptation actions, if the building of Community Resilience is not also part of the intervention.

H5: The control variables do not have an effect on the relationship between Community Resilience and Adaptation Behaviour.

As a final step, the influence of thirteen of the sixteen demographic control variables is tested for. The control variables Water Source, Prior Settlement and Religion are not taken into account for simplification reasons. The eleven selected continuous variables are tested with the Maximum Likelihood Method, while the two categorical ones are tested with a Multigroup

Analysis. The following Table 4 shows the influence of the continuous variables on the relationship between Community Resilience and Adaptation Behaviour.

Variable	Community Resilience in relation to Adaptation Behaviour
Without any Control Variables	**0,804*** **
With all Control Variables	0,727**
Age	0.782***
Length since Resettlement	0.843**
Number of Household-Members	0.750**
Household Income Level	0.725**
Education Level	0.796**
Caste Level	0.805***
Number of Floor	0.796***
Number of school-aged kids	0.798***
Unemployed 18+	0.828***
Illnesses and Disabilities	0.819***
Marital Status	0.803***

Table 4: Influence of the Demographic Control Variables (Author 2019)

As can be derived from Table 4, the most positively influential control variables are Length since Resettlement, Unemployment and Illness of Household Members. This means, the longer people are already living in Kannagi Nagar and the more household members that are either unemployed, ill or disabled, the higher the effect of Community Resilience is on their Adaptation Behaviour. The highest negative effect results from the variables Age, Number of Household Members and Level of Income. This signifies that the older the respondent is, the more people share an apartment and the higher the household income is, the less effectual is the Community Resilience on the adaptive actions taken. A negligible small influence have Caste Level, Marital Status, Number of Kids, Floor Number and Education. All in all, the effects are not very strong, but significant.

The influence of the two chosen categorical variables Gender and Reason for Resettlement was tested for with a Chi Square Difference Test in AMOS. The two models were freely estimated, except one path that was constrained to be equal across groups. No difference between the two respective categories was found as the p-value for both variables was not significant ($p<0.05$) (Table 12 in Annex 3.5). This means that neither gender nor the fact whether the people were forcefully resettled or moved to Kannagi Nagar voluntarily has an effect on the influence of Community Resilience towards Adaptation Behaviour.

Summary

The data analysis and the conclusions regarding the hypothesises are summarized with the following Table 5.

Hypothesis	Evidence based on the SEM in AMOS	Conclusion
H1. The six parameters create Community Resilience	network (β=0.704 p=0.000***), support (β=0.545 p=0.000***), trust (β=0.730 p=0.000***), place (β=0.592 p=0.000**), efficacy (β=0.411 p=0.000***), leader (β=0.111 p=0.246)	Supported (apart from Visionary Leadership, which is non-significant)
H2. Collective Efficacy is positively influenced by Sense of Community	β=0.355 (p=0.000***)	Supported
H3. Community Resilience influences Adaptation Behaviour positively	β=0.804 (p=0.000***)	Supported
H4. Community Resilience and Risk Appraisal in combination influence Adaptation Behaviour positively	Risk Appraisal alone: β=0.128 (p=0.329) In combination: β=0.186 (p=0.094*)	Supported
H5. The control variables do not have an effect on the relationship between Community Resilience and Adaptation Behaviour	Length (0.843**), illness (0.819***), unemployment (0.828***), age (0.782***), household members (0.750**), income (0.725**), education (0.796**), caste (0.805***), floor (0.796***), kids (0.798***), marital (0.803***) all in comparison to 0,804***	Not supported for length since resettlement, illness, age, number of household members, income and unemployment

Table 5: Conclusions regarding the Five Hypotheses (Author 2019)

4.3 Discussion

The survey with 150 respondents in the resettlement site Kannagi Nagar in Chennai produced data that confirms earlier observations and theories of scholars in the climate change adaptation and cognitive science fields and allows to draw further findings that add to the existing literature. The main results are that Community Resilience has a positive influence on Climate Change Adaptation Behaviour, which is intensified by a high Risk Appraisal, although that variable itself has no significant effect on Adaptation. Those findings are based on quantitative data and further supported by learnings from the eight qualitative interviews with residents of Kannagi Nagar and with the two researchers Vanessa Peter and Karen Coelho. In the following sections the results are discussed, clustered into the topics of adaptation action targeted at flooding and water scarcity and the roles of Community Resilience, Visionary Leadership, and Risk Appraisal.

4.3.1 Climate Change Adaptation Behaviour

The types of Climate Change Adaptation Behaviour are categorised in actions tackling flooding, water scarcity, and general livelihood strategies. The most frequent adaptation and coping actions in Kannagi Nagar in response to flooding are found to be firstly storing valuables in save places, secondly reading and listening to information about the immediate risk of flooding and thirdly joining community demands for a better waste management to diminish clogging. Common adaptation actions implemented in the resettlement colony

addressing water scarcity are reportedly wasting less water and encouraging others to do the same, buying water bottles in cans and storing water in tanks. Typical positive livelihood strategies include participating in community meetings, action groups and chit-funds, while prevalent maladaptive responses are getting loans from moneylenders and praying more. Additional adaptation and coping actions that respondents mentioned are, for example, distributing food, keeping the drainage clean, attending swimming courses, renovating the roads and lifting the entrance to the house. All in all, inhabitants of Kannagi Nagar reach in average 11 out of 27 points for their implemented adaptation actions, with a standard deviation of 3.76, which shows that they are moderately able to prepare for and adapt to destructive climate change effects. This result might be due to the many other challenges the households deal with in their everyday life, which are more urgent and pressing than a probable flood in the future. This lack of headspace for flooding preparation also gets reflected in the interviews: *"If the flood comes now, I act. But not before."* (Interview partner 1), and "*[…] I can't take any precautions at the moment*" (Interview partner 3). Adaptation to water scarcity, on the other hand, was a priority for the citizens. As Chennai faced a severe drought during the time of the field work, the lack of water was more urgent for the residents and adequate adaptation behaviour more visible: *"I am using less water, we don't waste water anymore and store it for a whole week."* (Interview partner 2). This shows that, as soon as a disaster hits, the people of Kannagi Nagar nevertheless employ strategies to increase their resilience and adaptiveness and are generally confident that they will be able to cope, also highlighted by respondents number 140: *"In disasters we can always join together and manage".* One of the key-informants for this study, Vanessa Peter (2019), also underlines the general resilience of the households of Kannagi Nagar: *"Communities* [in Kannagi Nagar] *are really resilient. […] A woman in the slum is the most resilient person I have ever seen".* Summarizing the above, it can be concluded that although in average the households of Kannagi Nagar only take a medium amount of precautionary measures to adapt to risks of flooding and water scarcity, in the moment when the disaster hits, they seem to be exceptionally resilient and well able to cope.

4.3.2 Community Resilience

One of the main findings of this research, aligned with third hypothesis, is the significant positive relationship between Community Resilience and Adaptation Behaviour. The quantitative data indicated that 22% of the change in Adaptation Actions can be explained through a change in Community Resilience, with a high and significant beta-value of 0.804 and a 1% significance level. This influence is also highlighted by the residents of Kannagi Nagar: *"I learned that the community has to help each other to overcome emergencies."* (Interview partner 3) and *"As a single family we can't survive: we have to work together."* (interview partner 5). The gathered quantitative and qualitative data validate the third hypothesis and show that a resilient community with strong social assets are essential for a successful coping with negative extreme weather events.

When looking at the first hypothesis, Social Network, Social Support, Trust, Place Attachment and Collective Efficacy emerged as reliable predictors of Community Resilience, while Visionary Leadership had no influence, which will be discussed in the following section. Moreover, the analysis revealed that four factors of Sense of Community, excluding Leadership, influence Collective Efficacy positively, validating also the second hypothesis. This effect of a supportive community, that works together and cares about the place, is also reflected in the statements of the residents: *"In 2005 we had massive protests for water, amenities and public transport. Protesters were in jail for 10 days – and then we got the proper facilities. Especially the youngsters joined together."* (Respondent number 140), and *"We demanded water, hospitals,… and it came!"* (Respondents number 91).

The correlations between the five interdependent factors reflect the process of how resilient communities are created: By building social networks of trust and support within families and between neighbours and the bigger community, which then consequently fuel the attachment to the place and intensify the feeling of collective efficacy. This self-reinforcing cycle is also reflected in the statements of two residents of Kannagi Nagar: Interview partner 7, who has a strong and broad support system, said that she felt *"[…] closest to the people who live next to me, especially my neighbours. My neighbours will definitely help if needed, they are like family for me. But also, to the people who have been resettled with me".* She participates in communal action like petitions because she believes that *"Everybody is powerful, for example we got the bus to Kannagi Nagar through a petition of the community".* Interview partner 6 also feels a strong Sense of Community and Collective Efficacy: *"I am the closest to the people of my area, we are really very close, and we help each other. My street is like my family. I am confident that the community will work together".* This perception then also translates into his active civic engagement: *"The government initiated a clothes collection for the Kerala flooding, so I helped to collect the clothes here in Kannagi Nagar. Lots of people donated clothes. Also, in our 2015 flooding I helped distributing clothes."* This qualitative data show with local examples how the sense of closeness to and strength of the community is correlated with civic engagement.

However other interviewees also give explanations why they are not able to support one another. Interview partner 1 believes that people are closest to their own families and does not feel a sense of community: "*People in the community mind their own business and only take care of themselves, not of other families. In emergency situations we only help our own family, they need to be safe*". Economic reasons are mentioned by respondent number 102, who justifies that "*Everybody lives in poverty here, that's why we can't help each other*" and by interview partner 2, who points out that *"[…] we don't work together on that issue because all of us have work and we need that money*". Likewise, key-informant Karen Coelho explains that the reason why people do not engage much in community work is that they work hard and long hours, in locations relatively far away in the city (Coelho 2019). Additionally, she interprets that people rather stay indoors to not be associated with the reputation of crime that the streets of Kannagi Nagar have (Coelho 2019). Moreover, the story of interview partner 4 illustrates how a low appraisal of Community Resilience can evolve and how this is intertwined with the many challenges they face: *"I don't feel close to anyone, I don't have friends nor family here. No one talks to me because I look like a beggar. […] I'm being ill-treated, especially because by husband is a drunkard. […] I have no confidence at all in us working together, everybody is self-focused and poor".* The above statements reflect the strong effect of competing concerns and everyday economic struggles of the households of Kannagi Nagar and how the lack of a trusting, supportive network can also decrease the belief in the power of acting together to adapt to hazards. In summary, these qualitative examples and the analysed quantitative data show that especially the correlated five factors, combined as Community Resilience, are crucial for the people in Kannagi Nagar to successfully adapt to climate change impacts.

4.3.3 Visionary Leadership

As mentioned before, no evidence of correlation was detected between the variable Visionary Leadership and any of the other parameters of Community Resilience. Additionally, the variable has no significant relationship with Climate Change Adaptation Behaviour either. A possible explanation of the lack of influence of Visionary Leadership towards Community Resilience in Kannagi Nagar might be the in the questionnaire predominant mention of leaders who can be characterized as service providers instead of enablers of households who are capable and confident to help themselves. Nearly all respondents mentioned the former

councillor TC Karuna as their leader. He is a well-connected city-level politician, does not live in Kannagi Nagar and is "*the uncle of the local councillor, or ex-councillor, now there is no councillor. He is very powerful there*" (Coelho 2019). Although he indeed "*has done a lot*" (Coelho 2019) and *"maintained the park, the streetlights and the roads"* (Interview partner 2), the author got the impression that the residents waited for him and the government to take action to ensure a better livelihood for them (see interview partners 4 and 6 in Appendix 2.2), instead of feeling empowered to take action themselves and pushing for change. The statement of interview partner 5 reflects this impression well: *"The liveability would be improved with a better drainage system with less clogging. But only the government can make this change. Because I can only clean up my own drainage and what if the others don't join?".* This phenomenon of lack of agency and "*sense of powerlessness*" (Coelho 2019) could be connected to the fact that many residents were forcefully resettled and believe that now it is the responsibility of the government to take care of them. In fact, the two local community leaders, that the author interviewed, were not mentioned as leaders by any of the other respondents, and even they themselves said, that they do not know if the locals would see them as their community leader (see respondent number 113 in Appendix 1.1). Also, the inhabitants seem to not believe in the impact of the local community leaders: *"There are so many community leaders here, but they can only influence such a small part. […] Only the government can really provide support."* (Interview partner 6).

The top-down, service provider view on the mentioned leaders make them appear like an external influence, instead of a player who is inherent to the community and increases their resilience, as summarized by respondent number 91: *"There is a councillor but not a community lead for the Santhome area".* This might be an explanation why the factor Visionary Leadership seems to be a disconnected, independent variable with no effect on the internal resilience of the community and on their civic engagement. However, the exact reason why Visionary Leadership had no significant relationship with neither Community Resilience nor Adaptation Behaviour in Kannagi Nagar cannot be confidently answered with the available data. Thus, a solid, fact-based explanation regarding this variable goes beyond the scope of this research and signifies one of its limitations.

4.3.4 Risk Appraisal

Before discussing the variable Risk Appraisal, two other limitations have to be elaborated on. Two factors, namely a bias because of competing concerns and the strong cultural beliefs, were not controlled for in this study but might have influenced the interviewees in their answers regarding Risk Appraisal. The first uncontrolled influencer is a bias based on competing concerns that might decrease the worry and perceived urgency of less present or pressing issues like a future flooding disaster in Kannagi Nagar. As Chennai was facing an extreme water scarcity during the data collection, it thus becomes clear why especially the Risk Appraisal towards flooding had rather low loadings in the CFA. While people were trying to survive with water provision only once a week, a concern for a future risk of flooding was not a priority. This impression is underlined by several of the respondent's answers, such as of respondent number 60: *"I do not worry about flooding because we do not even have enough rain".* The second uncontrolled factor decreasing the Risk Appraisal in Kannagi Nagar is the widespread belief in gods, who are the presumed creators of extreme weather events. This is reflected in the answers of some of the locals, for instance of respondent number 38 *"Only God knows, God is great",* and of interview partner 3 *"I do not feel powerful to make a change, not even the politicians can – only the gods.".* Also, the common adaptation action of increasing the number of prayers reveal the strong influence of this cultural belief. These two not controlled for factors represent two limitations of this study.

Two significant findings can nevertheless be concluded based on the quantitative data. They are supported by the qualitative interviews and are discussed in the following. The first finding is that Risk Appraisal has no significant statistical effect on Climate Change Adaptation Behaviour in Kannagi Nagar, with a non-significant beta-value of 0.128 in the Structural Equation Model. This shows that, while it is evident that people need to be informed about a possible risk to respond to it, the knowledge about the threat does not directly lead to enhanced climate change adaptation actions in the resettlement colony. Although all interview partners seemed worried and aware of the water crisis and the possibility of flooding in the area, their civic engagement and adaptation behaviour was not predictable based on their knowledge. While interview partner 2 is fully mindful of the water scarcity of the last summers, he does not believe in communal action to petition for more support: *"No one works together in regard to water scarcity, everybody takes care of this on their own. No one has done demonstrations for more or cleaner water".* Also interview partner 8 seems to have resigned and accepted the situation: *"In summer it is like this. Nobody can take any initiative, we all just use cans and take care of us individually".* The second finding concerning Risk Appraisal is, however, the realization that while Risk Appraisal alone has no influence, it intensifies the positive relationship between Community Resilience and Climate Change Adaptation Behaviour of the residents in Kannagi Nagar. Thus, in combination with Community Resilience the Risk Appraisal becomes effective towards Adaptation. This shows that only if residents have a trusting, broad support system and feel capable of achieving change as a community, they decide for taking action instead of opting for denial, fatalism or wishful thinking. This finding is illustrated by interview partner 6, who is informed about the risk and also seems to have found the needed support in his community to take tangible adaptation and coping actions: *"I am confident that the community will work together, because we have been living together already for many years. […] I do worry about climate change, but I don't know what to expect. […] But I helped to collect the clothes here in Kannagi Nagar. Lots of people donated clothes. Also, in our 2015 flooding I helped distributing clothes".* Concluding, the results of the research on Risk Appraisal in Kannagi Nagar indicate that only if the residents feel part of a resilient community, their awareness of the urgency and severity of risks can then lead to a better adaptation to climate change.

4.3.5 Control Variables

The main relation within the theoretical framework from Community Resilience towards Climate Change Adaptation Behaviour was tested for an influencing effect of thirteen selected demographic control variables. In the following, possible interpretations of the quantitative data are provided. The variables Length since Resettlement, Unemployment and Illness of Household Members are the strongest positively influential control variables. This could be explained through the fact that if people already live longer in Kannagi Nagar the importance they put on their community is higher and thus it becomes more influential. The same is applicable for households with members with disabilities, here the families might be more dependent on outside help and value the community more. Also, when more members of a household are unemployed, they might be stronger intertwined with the community because of more time at hand and a higher need for support. The strongest negative effects on the relation between Community Resilience and Adaptation Behaviour are revealed by the variables Age, Number of Household Members and Level of Income. An interpretation could be that especially older people, but also households with a large number of members or a high income do not need to depend as much on the bigger community to adapt to hazards. Quite possibly richer households can independently help themselves better because of their financial assets and larger households might get more support from their family network. This holds also true

for the elderly, who might be mostly dependent on their closest family instead of the whole neighbourhood. Thus, the positive effect of a resilient community becomes comparably weaker. No influence on the relation between Community Resilience and Adaptation Behaviour are found from the variables Gender, Reason of Relocation, Caste Level, Marital Status, Number of Kids, Floor Number and Education.

Chapter 5: Conclusion

After Thaker et al. (2016) proved the positive relationship between Collective Efficacy and adaptation to water scarcity in the Indian context, they flagged the need for "future research on other critical variables such as values, cultural orientations, and social capital to test the relative importance of Collective Efficacy and values in enhancing adaptive capacity" (p. 32). Also, Babcicky and Seebauer (2017) proclaimed the necessity for "including social capital as an explanatory factor in socio-psychometric models" (p. 1033) in the field of flooding adaptation. This was the starting point of this research, with the aim of understanding the role of the broader concept of Community Resilience with its social parameters Visionary Leadership, Social Network, Social Support, Trust, Place Attachment and Collective Efficacy towards Climate Change Adaptation Behaviour, theoretically and empirically.

As coastal cities in the Global South are among the most vulnerable to climate change (IPCC 2012) the city of Chennai in Tamil Nadu, India was selected as research site. The households of the resettlement site got displaced during the 2004 tsunami and evicted because of ecological river restoration projects, which should equip the city of Chennai to handle negative climate change impacts better (Coelho and Raman 2010, Peter 2017). However, in the new location the citizens face two major challenges: First, although the slum dwellers were relocated for climate adaptation reasons, they still have to cope with high risks of flooding in their new homes as they are built on former marshlands (Coelho and Raman 2010). And second, the residents' original community networks were likely destroyed through the relocation, and had to be rebuilt (IPCC 2001). This social disarticulation is one of the many adverse impacts of displacing informal settlers, manifesting in scattered social networks and raptured patterns of reciprocal help and trust (Cernea 1997). And while most aid schemes during resettlement focus on the urgent needs of finding a new workplace, building schools and hospitals, the re-establishment of a sense of community is often not taken into consideration (Cernea 1997). Yet, especially these people with already little financial, physical and human capital depend on exactly those social assets to enable their coping strategies for survival (Grothmann and Patt 2005). Based on the findings of Grothmann and Patt (2005), Lo et al. (2015), Thaker et al. (2016) and Babcicky and Seebauer (2017, 2019), this study posed the hypothesis that Community Resilience, in combination with Risk Appraisal, positively influences Climate Change Adaptation Behaviour.

Based on the results from the case study in the resettlement colony Kannagi Nagar, in Chennai, India, the analysis of the quantitative and qualitative data the research questions are answered in the following. Additionally, an updated theoretical framework is derived and implications for climate change communication and urban policy for resettlements, specifically for Kannagi Nagar, are drawn. The study is terminating with a proposal of topics for further research.

5.1 Answering the Research Questions

In order to understand the importance of improving the Community Resilience of the resettled residents of Kannagi Nagar, the following research questions were raised:

How does Community Resilience and Risk Appraisal of resettled households in Kannagi Nagar in Chennai, India influence their Climate Change Adaption Behaviour addressing water scarcity and flooding?

1. What are the key household climate change adaption actions, specifically tackling flooding and water scarcity, in Kannagi Nagar?
2. Which factors constitute Community Resilience and how are they interconnected?
3. What is the role of Community Resilience towards household adaptation behaviour?
4. What is the role of Risk Appraisal towards household adaptation behaviour?

The First Sub-Question

The first sub-question is answered with a thorough literature review, the collection of general livelihood strategies and possible adaptation actions towards flooding and water scarcity, that were then adjusted to the Indian context (Koerth 2013, Thaker et al. 2016, Singh 2018b and Singh et al. 2016). As proactive adaptation strategies were rather scarce, also ad-hoc coping actions were included (Singh 2018a). Generally, storing valuables in save places is reported to be the most frequent flooding adaptation action in Kannagi Nagar, while the most common adaptation action in response to water scarcity yields to wasting less water. Participating in community meetings stands out as the typical positive livelihood strategy of the residents, while a common maladaptive response is to pray more. All in all, the results illustrate that households of Kannagi Nagar are only moderately able to prepare for negative climate change effects, most probably due to competing concerns. This is in line with Grothmann and Patt who postulated in 2005 that risk judgements are relative to the individual's assessment of how severe and urgent their other problems or challenges are. Also, Linville and Fischer (1991) point out that humans have a limited capacity to worry and that an urgent worry in the present will decrease the worry about other possible issues, especially ones that lie in the future. Further, the results show that especially the actions tackling flooding are of a rather short-term nature, which suggests a resigned acceptance of living with the constant risk that the nearby marshlands bring, which is also diagnosed by the key-informant Vanessa Peter (2019): "People became used to the floods".

The Second Sub-Question

As an answer to the second research sub-question, the following six parameters of Community Resilience were identified: Visionary Leadership, Social Network, Social Support, Trust, Place Attachment and Collective Efficacy. This combination of factors is drawn from publications by Norris et al. (2008), Cohen et al. (2013) and Faulkner et al. (2018), who theorized and tested for their interconnectedness. This study confirms that in the context of Kannagi Nagar five of the six factors are strongly correlated with each other and significant parameters of Community Resilience. Additionally, a significant positive influence of the four factors Social Network, Social Support, Trust and Place Attachment towards Collective Efficacy could be proven. The findings are in line with Samuel et al. (2014) who theorized, based on Ajzen (1985), Bandura (1986) and Sampson (1997) that Collective Efficacy leads to collective action. They explain the process how resilient communities are built: Social networks of trust and support within families, the neighbourhood and the bigger community, which are also reflected in the attachment to the place, intensify the feeling of Collective Efficacy and, in combination, create a high Community Resilience.

However, this study has been unable to demonstrate that Visionary Leadership is a significant factor of Community Resilience, as declared by Fabricius et al. (2007), Leykin et al. (2013), Evans (2015) and Faulkner et al. (2018). A possible explanation for the inconsistency is that in the case study site Kannagi Nagar the predominant understanding of a leader seems to be a service provider instead of an enabler. This top-down leadership-style makes the leader an external influence, instead of an internal community asset that mobilizes the social networks and enables self-organization to elevate their resilience. However, the definite reason why Visionary Leadership had no significance in this research cannot be fully answered with the data at hand and represents one of the limitations.

The Third Sub-Question

The third sub-question in this study sought to determine the role of resilient communities towards household Climate Change Adaptation Behaviour. A profound positive influence (β=0.723**) of the Community Resilience of the households of Kannagi Nagar towards their Adaptation Behaviour was proven. This result shows that not efficacy alone, as researched by Grothmann and Patt (2005) and Thaker et al. (2016), or social capital as explored by Lo et al. (2015) and Babcicky and Seebauer (2017), but rather the combination of both – the broader concept of Community Resilience – has a strong positive effect on the Climate Change Adaptation actions. Beside the confidence in the power and effectiveness of the community, the trusted network, the provided help and emotional investment into the place play a crucial role as well. This study aligns with Long and Perkins (2007), Wickes et al. (2015), Collins et al. (2014) as they presented this relationship already for civic engagement in general. Paton and Johnston (2001), Pelling and High (2005) and Cinner et al. (2018) theorized the positive influence of Community Resilience, as a combination of social capital and Collective Efficacy, on climate change adaptation behaviour, but had not tested the hypothesis empirically.

The Fourth Sub-Question

The answer to the fourth sub-question is that Risk Appraisal has no significant influence on household adaptation behaviour, which reflects the current risk perception literature (Bubeck et al. 2012) and are in line with findings from Bubeck et al. (2013), Lo et al. (2015) and Truelove et al. (2015). The result shows that although a basic awareness of the existence of the risk is obviously needed, it does not act as a reliable indicator for implemented adaptation action. This is an important reminder as a positive relation is still supposed by many who hope that with more knowledge, more action will be taken (Gifford *et al.* 2011, Elrick-Barr et al. 2017). For the climate risk communication practice this entails that solely spreading knowledge of the risk will not facilitate the adoption of the appropriate behaviour (Paton and Johnson 2001, Bubeck et al. 2012).

The Main Research Question

As a combination of the responses to the four sub-question, the main research question is answered. The case study in the resettlement colony Kannagi Nagar in Chennai produced quantitative and qualitative data that proved a significant positive influence of Community Resilience towards adaptation to water scarcity and flooding. Especially in combination, the five factors Social Network, Social Support, Trust, Place Attachment and Collective Efficacy support a resilient adaptation. The trusted social support system and the belief in the community's efficacy have the potential to capacitate the residents of Kannagi Nagar to adapt to negative climate change effects. The results confirm the postulations of Paton and Johnston

(2001), Pelling and High (2005), Long and Perkins (2007), Collins et al. (2014), Wickes et al. (2015), Lo *et al.* (2015), Thaker et al. (2016), Cinner et al. (2018) and Babcicky and Seebauer (2017, 2019). Additionally, it was substantiated that while Risk Appraisal has no direct effect on Adaptation Behaviour in Kannagi Nagar, it does strengthen the positive relationship between Community Resilience and Adaptation towards flooding and water scarcity. This shows that only when the inhabitants have supportive backing from their network and feel confident about the community's capabilities, a higher awareness of a risk can further increase the number of adaptation measures taken.

Concluding, this study highlights that accommodating social-cognitive factors, such as the building of confidence in collective efficacy, trust and support systems, will be more impactful in boosting adaptation behaviour than solely raising awareness of the threat of climate change. These results demonstrate the insufficiency of information and risk awareness campaigns, but instead call for additional community-building initiatives and greater efforts on strengthening the capacity of communities to help themselves in order to increase climate change adaptation behaviour. These findings from a resettlement colony in India add original knowledge to the existing literature on climate change adaption and urban development, proofing the positive influence of Community Resilience towards Climate Change Adaptation Behaviour and the positive interactive effect of Risk Appraisal.

5.2 Improved Theoretical Framework

Applying the learnings from the data analysis, this Updated Socio-Cognitive Climate Change Adaptation Framework represents the findings of the study in a more precise way (Figure 10). Based on the results of the SEM, the non-significant variable Visionary Leadership is not included in this definition of Community Resilience. Also, the parameter Collective Efficacy is put on the same level as the other four factors, reflecting their countless interdependencies. Thus, the sub-element of Sense of Community is redundant and removed, which allows for more elegance and simplicity, similarly as how the Structural Equation Model was built for the analysis in AMOS. Furthermore, the lack of a direct influence of the variable Risk Appraisal is clearly displayed, as in the updated framework it only has a moderating effect on the relation between Community Resilience and Climate Change Adaptation Behaviour. This framework was applied in the study of the resettlement colony Kannagi Nagar but might also be useful in other resettlement site and contexts.

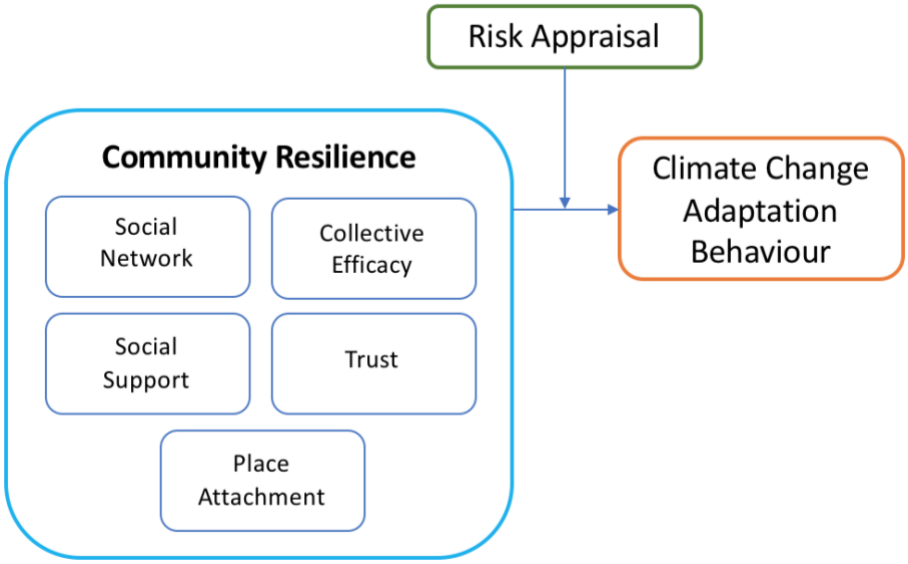


Figure 10: Updated Socio-Cognitive Climate Change Adaptation Framework (Author, 2019)

5.3 Implications of the Study in Times of a Climate Crisis and Further Research

The research at hand shows that Risk Appraisal has no direct effect on adaptation action, but is a positive moderator on the positive relationship between Community Resilience and Climate Change Adaptation Behaviour in Kannagi Nagar. This implies, that contradicting to current strategies of climate activists and researchers, the precondition to enable people to take climate change adaptation action is not by raising their risk awareness. Rather, the crucial focus should be put on building resilient, trusting communities, who are well connected, able to help themselves and belief in their power to make a difference. The thus following implications for urban policies of resettlement schemes and climate change communication are presented in the next sections. The study is finalized with a section on proposals for valuable further research.

5.3.1 Implications on Urban Policy for Resettlements

Based on the results of this research, the aspect of community building is proposed to be strongly considered in future-oriented, sustainable urban development policy regarding resettlements. Generally speaking, the study's findings underline the adversity of resettlements and support Cernea's (1997) postulation that social disarticulation has severe negative effects on the livelihood of the affected households. Especially in times of a climate crisis, the negative consequences of fragmented informal networks are intensified, as social capital and confidence in the community's power are exactly what people depend on to take adaptive action, as proven with this research for the case study site Kannagi Nagar. Instead of feeling enabled to help themselves, the social disarticulation makes the evicted citizens even more dependent on outside help. This effect might also be reflected in the observed lack of agency of the forcefully evicted residents of Kannagi Nagar, who feel like their fate is in the government's hands (Coelho 2019, Interview partners 4, 5 and 6). This makes resettlements as a municipality's strategy for climate change adaptation highly problematic as it can increase the dangers of low adaptive capacity at its source.

While the responsibility of governments to ensure a safe livelihood for its citizens can in no way be diminished, based on this research, a stronger focus on enabling community- and capacity-building initiatives in the study site is proposed. These are effectual bottom-up action-steps to increase the adaptation behaviour tackling flooding and water scarcity in Kannagi Nagar, and possibly also in other resettlement colonies. Not risk awareness raising should be the target but re-building resilient communities with members that are able and confident to help themselves. The aim of governments, NGOs, community leaders and slum boards should be to create the reinforcing loop described by Collins et al. (2014): Through civic engagement, residents increase the chance to develop trusting relationships, which give them a feeling of unity. This feeling of unity then increases their perceptions of Collective Efficacy, which again leads to more collective activities, where residents gather and meet. Tangible ways of creating this cycle and building communities, social capital and collective efficacy are plentiful and versatile. Researchers identify for instance volunteer stewardship programs, peer-to-peer education, trainings in communal conflict management and in climate change adaptation and mitigation measures, emergency management teams and communal tree planting as effectual actions (Lo et al. 2015, Crnčević and Orlović Lovren 2017, Choko 2019). Also the often successfully implemented policy concept called Community-Based Adaptation (CBA), which entails implementing bottom-up participatory processes to pinpoint climate change effects, build social capital and create locally appropriate community-based responses, could be an approach that adds value in Kannagi Nagar (Ayers and Forsyth 2009, Reid and Huq 2014). Based on the impressions during the field visits and the data analysis, community action days

for waste collection and drainage cleaning, shared early childcare as well as enabling a community change leader to drive those initiatives from a grassroots level are further suggestions for the resettlement site Kannagi Nagar. All the above examples of initiatives and policies entail the aspect of civic participation, with the aim to increase the number of social ties, promote social support, create a trustworthy environment and reinforce place attachment. Moreover, if the volunteer activities also involve actively and collectively dealing with flood and water scarcity mitigation, individual and collective efficacy are fostered as well (Paton and Johnston 2001). Those are all components, according to this study's results, that are highly relevant for building resilient communities. Concluding, future-oriented urban policies and initiatives in Kannagi Nagar and probably also in other resettlement sites need to place more weight on (re-)building resilient communities to enhance the citizen's adaptive capacity in times of a climate crisis.

5.3.2 Learnings for Climate Change Communication

The learnings from this research of the roles of Risk Appraisal and Community Resilience in Kannagi Nagar can also be transferred to Climate Change Communication practice. The results imply that while proclaiming the threat of global warming is vital, without also conveying collective efficacy and building resilient communities to manage those risks, there will be no effect on climate change adaptation behaviour of the citizens. In practice many advocates, NGOs, media and governments still believe that raising risk awareness will empower people to take action (Bubeck et al. 2012). Several studies and surveys, however, already demonstrated that although general awareness on the climate crisis is extending, this knowledge has not resulted in a similar increase of adaptation behaviour (Thaker et al. 2016). Already in 2005 Grothmann and Patt advise that information campaigns need to be complemented by the promotion of appropriate, effective and do-able adaptation actions for residents, otherwise people might feel overwhelmed and powerless and decide for denial, fatalism and wishful thinking. Babcicky and Seebauer (2019b) recommend communication strategies like creating anecdotal stories and highlighting successful implementations of household measures, but also organizing trainings that showcase the usage and effectiveness of adaptive measures. The study at hand supports those suggestions of Grothmann and Patt (2005) and Babcicky and Seebauer (2019b) and adds that also social networks, received and perceived support, place attachment and trust need to be built and communicated, in order to increase adaptation behaviour. Thus, climate change communication should motivating and should place communities at the centre to engage them in creating the adaptation measures together. This approach can be implemented in resettlement sites, as described above, but might also be generalizable and applied to media, companies and families.

5.3.3 Recommendations for Further Research

Further research should build on these findings and could test which other factors, for example values and culture, build Community Resilience and influence Adaptation Behaviour. Also, it could be further explored why Visionary Leadership was not significant in this research and how the effect of local politicians and empowering community leaders is different. Additionally, further research should test the findings of this study for replicability in other resettlement sites and urban neighbourhoods. To reach even more generalizability, it would be interesting to compare the Adaptation Behaviour and Community Resilience of different groups, such as associations that focus on climate action and people who are not part of these organizations.

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Annex 1: Survey

Annex 1.1 Household Comments during Survey

Respondent number 38:
“Only God knows, God is great.”

Respondent number 60:
“No worry about flooding because there is no rain.”

Respondent number 72:
“If we would join together it would be very helpful for our families as well. But we don’t.”

Respondent number 84:
“I can easily adapt to every place where I live.”

Respondent number 91:
“We demanded water, hospitals,… and it came!”
“There is a councillor but not a community lead for the Santhome area.”

Respondent number 92:
“We have metro water now, so it is actually easier to get water and the situation improved.”

Respondent number 99:
“Flooding is unpredictable. I am not the weather forecast.”

Respondent number 102:
“Everybody lives in poverty here, that’s why we can’t help each other.”

Respondent number 113:
“If an issue comes to my ears, I will fight for it!”
“I don’t know if the residents would see me as their leader.”

Respondent number 134:
“I won’t ask for help, I rather give.”

Respondent number 136:
“We are very organized during struggles, but mostly only the house.”
“Although I feel at home here, I know it is better somewhere else.”

Respondent number 140:
”In 2005 we had massive protests for water, amenities and public transport. Protesters were in jail for 10 days – and then we got the proper facilities. Especially the youngsters join together. In disasters we can always join together and manage.”

Respondent number 150:
“I would be happier somewhere else, but I would miss the people.”

Annex 1.2 Household Questionnaire

KANNAGI NAGAR COMMUNITY SURVEY QUESTIONNAIRE	
Purpose of the survey: The purpose of this survey is to gather data about the perception on Community Resilience and climate change of households in Kannagi Nagar. This will aid the students of Erasmus University Rotterdam in the analysis of their respective research works for their Master Thesis.	
Interviewer/Translator:	Control No:
Location:	
A. Respondent's profile	
1. Age: (1) under 20 (2) 20-29 (3) 30-39 (4) 40-49 (5) 50 or older	2. Gender: (1) Male (2) Female (3) Other
3. Education: (1) Primary (2) Secondary (3) Higher Secondary (4) Undergraduate Diploma (5) Undergraduate Degree (6) Post-graduate (7) Vocational (8) None	
4. How many years have you been living in Kannagi Nagar? (1) less than 1 (2) 1-2 years (3) 3-4 years (4) 5-6 years (5) 7-8 years (6) 9-10 years (7) 11-12 years (8) 13-14 years (9) 15-16 year (10) 17-18 years (11) 19-20 years (12) more than 20 years	
5. What was your place of residence before Kannagi Nagar?_____	
6. On which floor do you live in your apartment building? (1) groundfloor (2) 1st floor (3) 2nd floor (4) 3rd floor (5) other: _____	
7a. How many other people live in the same apartment with you? (1) 0 (2) 1 (3) 2 (4) 3 (5) 4 (6) 5 (7) 6 (8) 7 (9) 8 (10) 9 or more	
7b. How many of those are school-aged children? (1) 0 (2) 1 (3) 2 (4) 3 (5) 4 (6) 5 (7) 6 (8) 7 (9) 8 (10) 9 or more	
8. What is your current source of water? (1) Metro (2) Borewell (3) Paid lorry water (4) Bottles and cans (5) Other: _____	
9. What is the predominant religion in your household? (1) Hinduism (2) Christianity (3) Islam (4) Buddhism (5) not religious (6) I don't want to answer (7) Interreligious (Religions: _____)	
10. What is your average monthly Household Income? (1) up to 2000 rs/month (2) 2001-4000 rs/m (3) 4001-8000 rs/m (4) 8001-12.000 rs/m (5) 12.001-16.000 rs/m (6) 16.001-20.000 rs/m (7) more than 20.000 rs/m (8) Don't want to say	
I. How many people in your household (18+) are unemployed? (1) 0 (2) 1 (3) 2 (4) 3 (5) 4 (6) 5	
II. What is the caste of your household? (1) FC (2) BC (3) MBC (4) SC/ST	
III. Does anyone in your household have an illness / disease? (1) Yes (2) No	
IV. What is the status of the household head in your family? (1) single (2) married (3) divorced (4) separated (5) widow/er	
V. Have you been resettled? (1) Yes (2) No	

B. Collective Efficacy						
How **confident** are you that your community...						
11. can work together to make sure that everyone has enough safe drinking water?	(1) Not at all confident	(2) Not very confident	(3) neutral	(4) confident	(5) Very confident	(6) I don't know
12. can work together to make sure that everyone is safe from flooding?	(1) Not at all confident	(2) Not very confident	(3) neutral	(4) confident	(5) Very confident	(6) I don't know
13. Overall, how much influence do you think your family and you have in making this community a better and safer place to live? (1) no influence (2) hardly any influence (3) neutral (4) some influence (5) much influence (6) Idk						
14. What proportion of people from Kannagi Nagar contributed time or money toward helping each other during and shortly after the flooding in 2015? (1) hardly anybody (2) a few (3) some (4) many (5) most (6) I don't know						
15. How successful have you as a community been in the past to overcome a disaster together? (1) not successful at all (2) not very successful (3) neutral (4) successful (5) very successful (6) Idk						
16. How prepared and organized is your community for emergency situations? (1) not organized at all (2) not very organized (3) neutral (4) organized (5) very organized (6) Idk						
C. Risk Appraisal						
17. How likely do you think that water scarcity in Chennai will continue to be a problem in the coming years? (1) not likely at all (2) not very likely (3) neutral (4) quite likely (5) very likely						
18. If a two months long severe drought happens in Kannagi Nagar, how big of a negative influence would it have on your household's drinking water supply? (1) not big at all (2) not very big (3) neutral (4) quite big (5) very big						
19. Do you worry more or less about water scarcity, than 5 years ago? (1) a lot less (2) a bit less (3) stayed the same (4) a bit more (5) a lot more						
20. How likely do you think that flooding in Chennai will occur again in the coming years? (1) not likely at all (2) not very likely (3) neutral (4) quite likely (5) very likely						
21. If a three day long flooding would happen in Kannagi Nagar, how big of a negative influence would it have on your household? (1) not big at all (2) not very big (3) neutral (4) quite big (5) very big						
22. Do you worry more or less about flooding, than 5 years ago? (1) a lot less (2) a bit less (3) stayed the same (4) a bit more (5) a lot more						
D. Adaptation Behaviour						
23. I'm going to read out some forms of actions that people take to adapt to **flooding**. I'd like you to tell me, for each one, whether you or a household member of yours has done any of these actions, might do it or would never do it.						
a. Store valuables (documents, jewellery, cash) in designated places where I can find them quickly in cases of flooding	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know		
b. Install barriers that prevents floods to enter the house in case of emergency	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know		
c. Store food and water for emergencies	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know		
d. Move in with relatives or friends who live in safer places	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know		

e. Evacuate to a public building, when the municipality recommends it.	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
f. Read and listen to information about the risk of flooding	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
g. Initiate or join community action to clean drainage by clearing debris	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
h. Join community demands for better waste management to diminish clogging	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
i. Join a community training for emergencies	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
j. Learn about or create a community evacuation plan	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
k. Other actions you have implemented to adapt to flooding after the flooding 2015? Like: _____	(1) have done it	(2) might do it	(3) nothing else	(4) I don't know
24. I'm going to read out some forms of actions that people take to adapt to **water scarcity**. Also here, I'd like you to tell me, for each one, whether you or a household member of yours has done any of these actions, might do it or would never do it.				
a. Join sit-ins, blockages, strikes or petitions to demand more safe drinking water for your community	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
b. Be mindful to waste less water	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
c. Actively encourage others to waste less water	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
d. Buy water in bottles or cans	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
e. Reuse of water in the household	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
f. Get water from a well	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
g. Store water in water tank	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
h. Harvest rainwater	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
i. Read and listen to information about water scarcity	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
j. Source water from relatives or friends	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
k. Other actions you have implemented to adapt to water scarcity? Like: _____	(1) have done it	(2) might do it	(3) nothing else	(4) I don't know
25. I'm going to read out some **general** forms of actions that people take to adapt to **changing circumstances** because of water scarcity and flooding. Also here, I'd like you to tell me, for each one, whether you or a household member of yours has done any of these actions, might do it or would never do it.				

a. Get loans from relatives	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
b. Participate in community meetings and action groups	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
c. Join a chit fund / saving group	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
d. Join a self-help group	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
e. Get loans from moneylenders or sell jewellery	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
f. Pray more because of higher risk	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know
g. Let children drop out of school	(1) have done it	(2) might do it	(3) would not do it	(4) I don't know

E. Visionary Leadership
26. Does your community have a leader, who might not be politician but more a grassroots leader? (1) Yes , Name: (2) No (3) I don't know
27. How well is the Community Leader leading to development and to create a positive future? (1) Not at all (2) hardly (3) slightly (4) much (5) very much (6) I don't know
28. How much does the Community Leader enable your community to trust and support each other more? (1) Not at all (2) hardly (3) slightly (4) much (5) very much (6) I don't know
29. Do you respect or fear the Community Leader? (1) Fear him (2) Fear him a bit (3) neutral (4) respect him (5) respect him very much (6) I don't know

F. Social Network	
30a. How many immediate family members and friends do you have in your community? (1) Less than 10 (2) between 10 and 20 (3) between 21 and 40 (4) between 41 and 60 (5) more than 60 (6) I don't know	30b. How strong would you rate your connection with them? (1) Very weak (2) rather weak (3) neutral (4) rather strong (5) very strong (6) I don't know
31a. How many neighbours do you and your spouse know by name in this community? (1) Less than 10 (2) between 10 and 20 (3) between 21 and 40 (4) between 41 and 60 (5) more than 60 (6) I don't know	31b. How strong would you rate your connection with them? (1) Very weak (2) rather weak (3) neutral (4) rather strong (5) very strong (6) I don't know
32a. How many influential, powerful people in Chennai do you and your spouse know personally? (1) Less than 2 (2) between 2 and 5 (3) between 6 and 8 (4) between 8 and 10 (5) more than 20 (6) I don't know	32b. How strong would you rate your connection with them? (1) Very weak (2) rather weak (3) neutral (4) rather strong (5) very strong (6) I don't know
33. In which of those organizations/groups/NGOs based in Kannagi Nagar are you or your spouse a member of? (1) Religious (2) Residents Association (3) Environmental (4) Arts (5) Music (6) Sports (7) Political (8) Union (9) Other (10) none	

G. Social Support						
How often have the following actions happened?						
34. You and people in your community do favours for one another.	(1) never	(2) rarely	(3) sometimes	(4) often	(5) Very often	(6) I don't know
35. You and people in your community support one another emotionally in hard times.	(1) never	(2) rarely	(3) sometimes	(4) often	(5) Very often	(6) I don't know
36. You and people in your community share important news with one another.	(1) never	(2) rarely	(3) sometimes	(4) often	(5) Very often	(6) I don't know
37. Do you believe that your family and you would receive help from the community in a crisis? (1) Not at all (2) not very much (3) somewhat (4) much (5) completely (6) I don't know						

H. Trust						
How much do you trust the people from the following groups that they won't take advantage of you?						
38. Your family and friends	(1) not at all	(2) not very much	(3) somewhat	(4) mostly	(5) completely	(6) I don't know
39. Your neighbours	(1) not at all	(2) not very much	(3) somewhat	(4) mostly	(5) completely	(6) I don't know
40. Your Community	(1) not at all	(2) not very much	(3) somewhat	(4) mostly	(5) completely	(6) I don't know
41. How strong is the feeling of closeness in your community? (1) very distant (2) rather distant (3) neutral (4) rather close (5) very close (6) I don't know						

I. Place Attachment
42. How proud are your family and you when you tell others that you live in Kannagi Nagar? (1) not proud at all (2) not very proud (3) neutral (4) a bit proud (5) very proud (6) I don't know
43. How at home do your family and you feel in Kannagi Nagar? (1) not at home at all (2) not very at home (3) neutral (4) a bit at home (5) very at home (6) Idk
44. Would your family and you be sorry to leave Kannagi Nagar? (1) not sorry at all (2) not very sorry (3) neutral (4) a bit sorry (5) very sorry (6) I don't know

Annex 2: Interviews

Annex 2.1 Interview Guideline for Households

FLOODING

1. Tell us about the 2015 flooding:
   - How did the community work together?
   - What are the lessons you learned?
2. Has the experience of flooding become worse in the last years?
3. How confident are you that your community can work together to make sure that everyone is safe from flooding? - Why?

WATER SCARCITY

4. Has the experience of water scarcity become worse or better in the last years?
5. How are you coping with the water scarcity?
6. How confident are you that your community can work together to make sure that everyone has enough safe drinking water? - Why?

PREPAREDNESS

7. How prepared and organized is your community for emergency situations?
8. How successful have you as a community been in the past to overcome a disaster together? - Why?

COMMUNITY

9. Do you feel close to your community?
   - With whom especially? (block, street, location you've been resettled from)
   - Why?
10. Do you feel that you get help from your community?
    - Why/why not?
11. Are you engaging in community action?
    - Why/why not?
12. Do you feel as a community you can improve the liveability in Kannagi Nagar?
    - How and why?
13. Do you feel powerful or powerless to make change happen? Are you waiting for the government/politicians to help, or do you and your community help themselves?

Annex 2.2 Interview Responses of Households

Interview Partner 1

FLOODING

1. We were not able to leave the house, people from around the house helped each other. Especially young boys and people from the same building. Water entered the house. There was no support from external NGOs or the government. I didn't learn any lesson, I am not capable to think about precautions, I am not educated. If the flood comes now, I act. But not before.
2. The flooding in 2015 was the worst, I don't know what will happen in the future. When it comes, we act.
3. People in the community mind their own business and only take care of themselves, not of other families. No believe in flooding.

WATER SCARCITY

4. Less scarcity since we have gotten Metro water, approx. once per week for 15minutes.
5. We go to the bus stand, there is a water depot, where we can get water in case the weekly ration is not enough. Often the metro water is very dirty, because sewage enters and also the pipelines do not get cleaned. Our drinking water we only get from cans, not from the metro water.
6. I notice that we have a less heavy monsoon and that the ponds are drying out. The government provides us with beach water. I am worries about the water scarcity. The community is not working together to clean the pipes.

PREPAREDNESS

7. In emergency situations we only help our own family, they need to be safe.
8. No story of success comes to my mind.

COMMUNITY

9. I do not feel close to anyone, not even to people from the same block or the street. But I am friendly to everyone.
10. No, I do not get any help from the community.

11. I am not engaged myself, and for cleaning the drainages we rather get money together and pay somebody to do it.
12. I only see self-concern, there is no community feeling, no improvement of livelihood is possible.
13. I feel powerless. The government does not do anything: Even if a murder happens, there are no consequences. No change will happen in Kannagi Nagar.

Interview Partner 2

FLOODING

1. There was actually not too much flooding in my area, also no water came into our house. But the community didn't work together. We had to travel really far to get some food. What I learned is that we need to be in a safe place like a school and move out of our house in case of extreme flooding.
2. The flooding in 2015 was the worst, nothing comparable happened since then.
3. I am sure that the community will work together if flooding happens again. Everybody here has the same mindset. To protect their families the community will work together to prevent illnesses and more. But I'm still worried.

WATER SCARCITY

4. There was definitely less rainfall and the lakes are drying out, it is already happening for two years in a row during summer.
5. I am using less water, we don't waste water anymore and store it for a whole week.
6. No one works together in regard to water scarcity, everybody takes care of this on their own. Also, we don't work together on that issue because all of us have work and we need that money. No one has done demonstrations for more or cleaner water.
The metro water we only use for bathing and for washing clothes. Drinking water, we buy in cans.

PREPAREDNESS

7. We are neither prepared nor organized for a crisis. We are all daily wage workers and have no savings.
8. Everybody takes care of themselves to overcome disasters – not together.

COMMUNITY

9. I am closest to my block and the other Santhome people. We are all related, that keeps us close.
10. We can't expect any help from the community because everybody is struggling.
11. I am not part of any communal action.
12. No improvement is possible.
13. TC Karuna, our councillor, changed the lives of the people of Kannagi Nagar. He maintained the park, the streetlights and the roads. But I cannot remember any bottom-up initiatives like demonstrations for schools or similar.

Interview Partner 3

FLOODING

1. The water level was high, but it did not enter our house. The community did not help each other. I learned that the community has to help each other to overcome emergencies – but I can't take any precautions at the moment.
2. 2015 was the worst flooding, but I am nevertheless worried about the future.
3. The community does not work together, but I might help them.

WATER SCARCITY

4. I am worried about the dried lakes, this year is the year with the worst water scarcity, but it is already for two years like this.

5. Every week we are storing the water, and we try to save it. But the metro water is unsafe for drinking, but instead of petitioning for improvement, the whole community buys can water.
6. I would come forward, but I don't know of any organization.

PREPAREDNESS

7. NA
8. I do not remember any success story.

COMMUNITY

9. I am closest to the Santhome people.
10. No, I would not get help from anyone in the community, not even from friends.
11. NA
12. Everybody should take an initiative – but nobody does – so nothing changes.
13. I do not feel powerful to make a change, not even the politicians can – only the gods.

Interview Partner 4

FLOODING

1. The community did not work together in the 2015 flooding. I was not even able to get milk for my child. Finally, a police woman helped me getting some milk and food.
2. The 2015 flooding were the worst.
3. I have no confidence at all in us working together, everybody is self-focused and poor.

WATER SCARCITY

4. Already in the last 2-3 years we had less and less water but this year, without rains, it is the worst.
5. I am using and wasting less water, and I'm sharing.
6. The community does not work together. I even have to use the metro water for drinking as we don't have enough water to buy it.

PREPAREDNESS

7. We can't be prepared for emergencies.
8. I don't believe in any success of the community.

COMMUNITY

9. I don't feel close to anyone, I don't have friends nor family here. No one talks to me because I look like a beggar. I'm being ill-treated, especially because by husband is a drunkard.
10. No, there is no help from the community.
11. I do participate in community actions like street cleaning, but I don't talk to anyone.
12. If we would work together, it would be positive.
13. The government is the only one who can change something.

Interview Partner 5

FLOODING

1. The community worked very well together in the 2015 flooding, we shared food, sanitary napkins, milk powder for the kids – which we got from the government. I learned to not leave important things on the floor or on lower shelves, but to put it further up, like documents and electronic devices.
2. NA
3. I am not sure if the community will work together in the future. The government does work on things but only in certain areas, other areas are left alone.

WATER SCARCITY

4. There was less rain and the lakes are drying out, we have water scarcity already for the last two to three years in the summer.
5. We are storing water in the plastic drums, as we only get water once a week. With the handpump we get water for 4 hours. But for drinking water we have to buy can water. We used

to boil and drink the metro water, but then the kids got sick. We just don't have a facility to clean it properly.
6. As a single family we can't survive: we have to work together.

PREPAREDNESS

7. We have to be prepared as a community.
8. I don't know any success stories, in 2015 I left Kannagi Nagar with my family and we fled to relatives who live close by.

COMMUNITY

9. I am closest to the people on my block, who live in my area.
10. I don't expect and want any help, because if they help once, they want to be involved in your whole live and make you dependent on them.
11. No.
12. The liveability would be improved with a better drainage system with less clogging. But only the government can make this change. Because we can only clean up my own drainage but what if the others don't join?
13. NA

Interview Partner 6

FLOODING

1. The government helped and provided food, fallen trees were removed by the community, water entered the house and the roads were not proper then. We lost many things.
2. I do worry about climate change, but I don't know what to expect.
3. I am confident that the community will work together, because we have been living together already for many years. My street is like my family and we always help each other.

WATER SCARCITY

4. There has been less rain in the last years. And as we only get water once a week, we have to use the depot beside the bus station for extra water. We save it in the drum and waste less. We don't buy cans because we fixed the aquawater cleaner. The problem is though that nobody cleans the pipes.
5. NA
6. NA

PREPAREDNESS

7. Whatever I can do, I do and help others to stay save as well.
8. The corporation built new roads and heightened the houses after the 2015 flooding. So, we are saver now.

COMMUNITY

9. I am the closest to the people of my area, we are really very close, and we help each other.
10. Yes definitely, they would help me.
11. The government initiated a clothes collection for the Kerala flooding, so I helped to collect the clothes here in Kannagi Nagar. Lots of people donated clothes. Also, in our 2015 flooding I helped distributing clothes.
12. It's especially the government that helps with building the bus stations, a 2nd police station and more frequent bus times.
13. Only the government can really provide support. I am not aware of any community led demonstrations or TC Karuna. There are so many community leaders here, but they can only influence such a small part.

Interview Partner 7

FLOODING

1. The water entered the house and I had to stand in the table with my 3month old child, without milk for her or food for myself. There was no drinking water, it was really a critical situation. It really was a nightmare. But luckily my neighbour bought some milk for me. The whole community distributed food and shared their milk. The thing is, the lake is very close, so the flooding was really high here and we were not able to move out of the building. It took us 2 weeks until we were back to the normal life. The lesson I learned was to be more prepared and to save possessions and have milk in storage. Otherwise food and water get very costly. Also, next time we would leave the house before the flood comes.
2. NA
3. NA

WATER SCARCITY

4. NA
5. We get metro water once a week for one hour, but it is brown-yellow, so we cannot drink it. I'm very aware of the water scarcity but storing the water only helps a little bit. Without rain we can't do anything.
6. We as a community can't make the water clean, this has to be done by the cooperation. But they don't do it, so we have to buy drinking water in cans.

PREPAREDNESS

7. If an emergency is announced, we can prepare and get organized. But not before.
8. The roads were improved, and the houses were lifted. But this was not done by the community but by the government.

COMMUNITY

9. I feel closest to the people who live next to me, especially my neighbours. But also, to the people who have been resettled with me.
10. My neighbours will definitely help, they are like family for me.
11. I was part of a petition for a proper drainage system.
12. We could improve our liveability if we had a proper drainage system and everybody would do rainwater collection. But this needs to be started by the government.
13. Everybody is powerful, for example we got the bus to Kannagi Nagar through a petition of the community. I do not believe in the government at all.

Interview Partner 8

FLOODING

1. Hardly anyone helped. We vacated our house to a safer place before the flooding came.
2. We live on the first floor, so it is not too bad. And nothing like the 2015 flooding happened anymore.
3. The individual safety comes first.

WATER SCARCITY

4. In summer it is like this.
5. NA
6. Nobody can take any initiative, we all just use cans and take care of us individually.

PREPAREDNESS

7. Only when we get information about the emergency, organization is possible.
8. I don't know any success story.

COMMUNITY

9. I'm quite neutral, but I guess people from the area are the closest.
10. I didn't have any problem till now, but when something happens I trust that I will get full support.

11. I helped with cleaning the drainage system and with cleaning the streets.
12. Starting a business can really change the life.
13. We got the CCTV instalment because we petitioned for it. I think we as a community are more powerful than the government – we have proven this through actions already. I'd be very sorry to leave from here as I have become attached to the neighbours.

Annex 2.3 Transcription of Interview with Karen Coelho (excerpt)

This interview with Karen Coelho was conducted by Sarah Haas in the Madras Institute of Development Studies in Chennai, on 10.07.2019.

S: My topic is about the Community Resilience of people in Kannagi Nagar, and I ask most of the questions to the people themselves but wanted to get your – perhaps a bit meta – view on the topic. So, what was your impression of the strength of the community in Kannagi Nagar, do you feel that they were quite close, or was there not a lot of social support?
K: Again, like I said: No. I think the people, well, there are a lot of small micro-neighbourhoods, and within the micro-neighbourhood's people are maybe quite connected, but also remember that in the first-place people were mixed up when they went there, and the second place a lot of people have shifted. The change is very fast, so there are a lot of rentals, and people come from outside, so neighbours are basically strangers. So, it takes time, with a constantly shifting community, and because they all come from the lowest income groups, there's a lot of suspicion, there's not a lot of immediate trust. There is a lot of need and if people are needy they are, you know, unless you know people from a long time you're suspicious of them. And then, the other issue, is because people are working so hard, long hours, kids come home from school, you don't have that much time to engage in community work, as you would have in the city when you were stepping out, doing work and then coming home. You also have time to engage with neighbours, have meetings, and plan things together. Here, I heard a lot of people say, especially men, I come home so late at night, I don't want to step out of my house, I want to hang out in my house and spend time with my children. And the other thing is that because there is so much of reputation of crime, etc. people don't want to engage with that. They feel like I would rather stay indoors and not be seen as a part of this. So, it is quite fragmented, that's the general impression.
S: I got the same impression, that some are not really not trusting at all, and others a lot, it is quite divided, and I still need to find out why, what is the difference between them. And then regarding climate change adaptation, I had the impression they don't understand climate change, they are not aware that it will become more intense. They mostly say if I ask about flooding or water scarcity they say I am not a weather forecast and I don't know, would you say that people have the confidence that they can change something themselves, or are they now because they have been resettled, they think they are in the hands of government or gods and just waiting?
K: Latter, I think definitely there has been a sense of powerlessness, and they can't do much, but over time they were able to do a lot for themselves. They have brought in water, through their protests and demands etc. They have been able to ensure that they get more regular water supply and better connections. So, they have become a political constituency, which have brought them certain things. But if you ask them to be aware of climate change, etc. I mean we are not, the middle class, and the president of the most powerful country in the world is not aware of climate change. So, I think to talk about awareness of climate change, will be a bit anachronistic, but to say have you observed that the experience of floods is worse, you can work off people's observations not their knowledge.

S: That's how I do it, I don't even mention the word climate change, if I ask them are they worried about water scarcity more now, than five years ago.
K: Has the experience of water scarcity become worse in the last few years? I think as a method in qualitative research, what people can give you, is when they're confident of their answers. They can say "Yes, we've seen droughts come more frequently", and therefore it's easier for them to talk about them, they have fears about it. That's not evidence for you. So, you need to work with what has been experienced, what has been observed, then you ask them if they feel the trend of those things. I think then also the question of how they are coping, that will tell you about it, have you developed new ways to cope with it, you know, if things are getting worse, are there new ways in which people dealing with. The 2015 flood is a good thing to get a lot of stories, then you can say what happened after. If one of the floods came again this December, in the rainy season, would you have any different way to deal, what are the lessons you learned from it.
S: And then two short questions, I'm asking many of them, all of them, if there are any grassroots leaders, they mostly mention the councillors but not anyone else who came out of the community who's leading?
K: So how are you sampling your neighbourhoods?
S: I try to cover all kind of parts of Kannagi Nagar.
K: Are you finding any difference about who they mention?
S: Mostly between councillor and nothing, so I have not met anyone who said there's this person, called, who is doing that.
K: That is surprising to me because I think there are many, there are a few local activists, but now, I think there are fewer now. Also, because politics have taken over there, so anybody, including somebody like Steven who is a long-term activist, he is now running as a councillor.
S: The thing is, nobody mentioned Steven. We met him at the beginning and now I have 60 interviewees, and nobody mentioned him.
K: No, but I think he would be only mentioned din a certain area. Mostly in the area where people came from Santhome, Thideer Nagar, the particular 3-storey blocks, they would know his influence, I think it has become more and more constrained. I don't know how much is growing out of that. I think there are a lot of competitors in that sense. There are a lot of political parties working there, Dalit parties, etc. I know that Steven himself has been wanting to run for councillor because you need resources to do anything, then he can say I'll get a hospital, drainage etc. Has anyone mentioned Karuna, he is a city-level politician, he's actually the uncle of the local councillor, or ex-councillor, now there is no councillor. He is very powerful there, he has done a lot. Maybe everyone ascribes it to – whom did they mention?
S: I did not always ask for the names, they always said the councillor and it was very diverse between respecting him or just not caring, because they say he just talks. I specifically ask for non-politicians but grassroots leaders.

Annex 2.4 Transcription of Interview with Vanessa Peter (excerpt)

This interview with Vanessa Peter was conducted by Atika Almira in Kodambakkam in Chennai, on 24.07.2019.

A: Do you think that if they have a better sense of community they are more resilient towards issues like water scarcity, floods or even the improvements of their livelihoods?
V: First, people should be treated in a dignified way, they should not even trust any processes. It is very easy to blame a community, they are not coming together, they are not doing this. [unclear] Certainly, the resilience part of it [unclear]. Communities are really resilient. [unclear] You and I would never be able to [unclear]. Throughout their lives they have

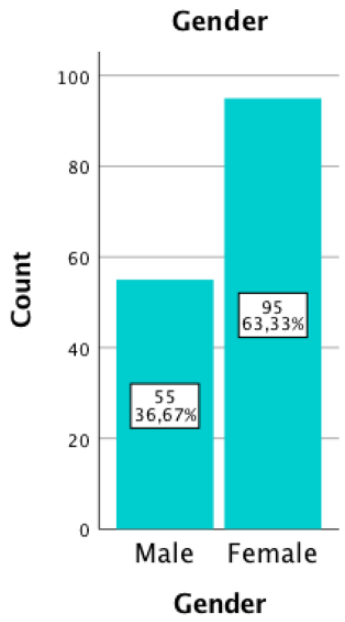
struggled. If you ask a woman in the slum, she is the most resilient person I have ever seen. Self-resilience, right. She has faced a harsh life, she knows how to take care of her children, she knows how to earn for her family. [unclear] She is being beaten up for the rest of her life by her husband. There is so much of domestic violence. She has strength for her children, she has strength for herself. [unclear] Quite naturally she is still continuing [unclear], she wants to educate her child. [unclear] That is resilience. I think we should celebrate that resilience. The moment you celebrate that resilience, the moment you celebrate diversity, the moment you celebrate the fact that this people are somehow different, if it is a racial discrimination in some countries [unclear]. […]
All the things that we are talking about has to be done by the government. [unclear] Every other thing has to work. What the can bank on, is the resilience of the communities, and people know that. […]
In Kannagi Nagar every day you survive [unclear]. Scarcity, the provision is always a bigger problem. Abundance of anything is never a problem. Anything in abundance. Surplus of water is [unclear] every year this happens during monsoon, people just became used to the floods. 2015 changed it all because of the intensity of floods. The floods were [unclear]. That's what I said, it's not abundance that is the issue, scarcity that's always the issue. Always live in a place that [unclear]. The problem about Kannagi Nagar is that the entire neighbourhood around Kannagi Nagar will have a water connection [unclear] because there is a problem that the water provision is a department, this guy is a different department, [unclear] is a different department [unclear] is in a different district, then it became part of Chennai district and all jurisdiction and all things are there. That's an answer in just a [unclear]. What I learned from my work, we all have the habit of looking at it from our perspective [unclear] bottoms-up perspective. What they see the issue and how we see it an issue is very different. […]
Because you are made to think that you can take anything that the government gives you, it's sort of charity what they give you. But people are not understanding this [unclear]. […]
Because when your life is full of struggle, you don't have a damn time to think about any of these things. You have struggles based on a daily basis.

Annex 3: Additional Graphs, Figures, Tables and Explanations

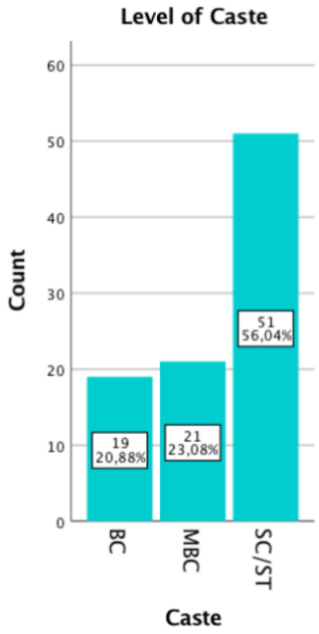
Annex 3.1 Addition corresponding to Sub-Chapter 3.7

To prepare the data for the analysis in SPSS and AMOS, a few preparatory steps had to be conducted. First, in Excel, the responses of the flooding, water scarcity and general adaptation actions were transformed into points (Have done = 1 point, Might do = 0.5 points, Would not do = 0 points). Exceptions were Questions 25e), 25f), and 25g) as those are maladaptive actions, and 1 point was allocated for not implementing it, while 0 points were given for having done it. The points were summed up and three new continuous variables were created: sum_flood, sum_wat, and sum_adapt. The more actions were implemented, the more points and the higher the respondent scores on the adaptation scale, with a maximum of 27 points.
Also, in Excel, all missing data were labelled as 999. Then, in SPSS, the correspondence between 999-items, „I don't know" and "I don't want to say"-answers and missing data was generated. In a second SPSS file, which will then was used for the SEM analysis in AMOS, all missing values of all independent variables were replaced with a 'Median of nearby points' and the dependent variables with 'Smean'. No outliers were identified, that would have needed to be excluded. Additionally, Value Labels were added to all variables and the measurement type was adjusted.

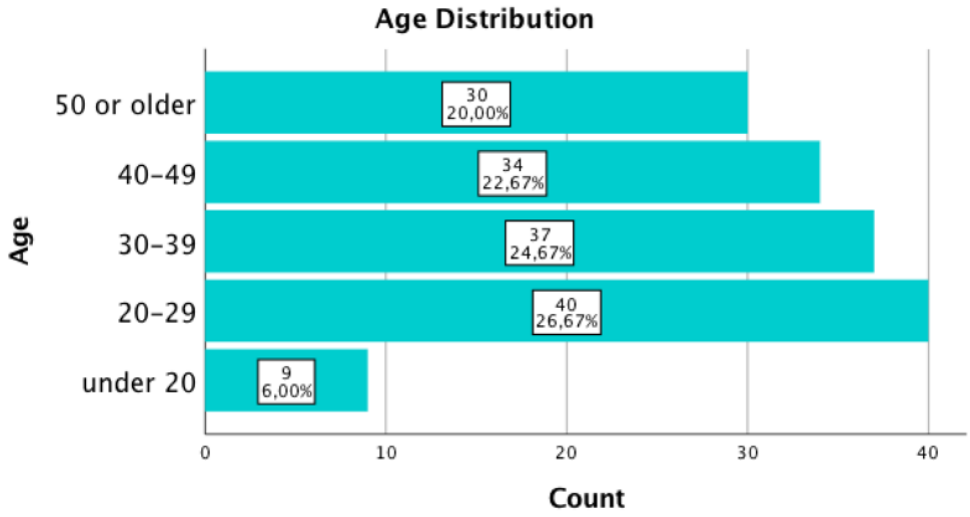
Annex 3.2 Addition corresponding to Section 4.2.1



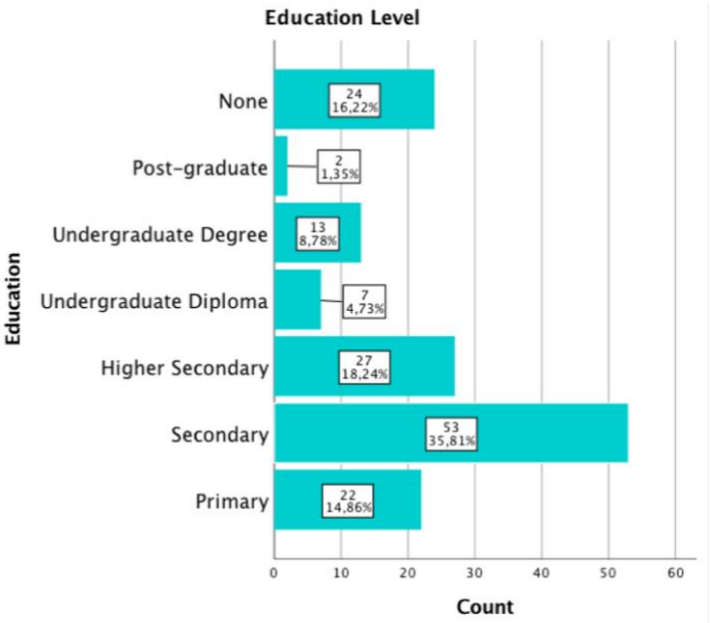
Graph 8: Gender Distribution (Author 2019)



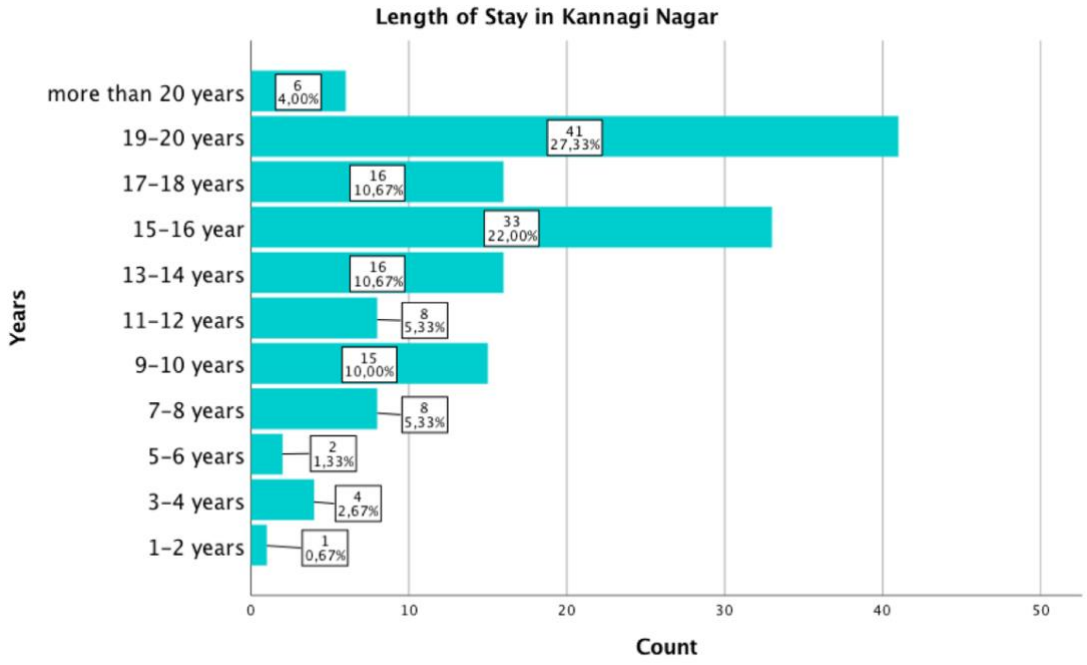
Graph 9: Caste Distribution (Author 2019)



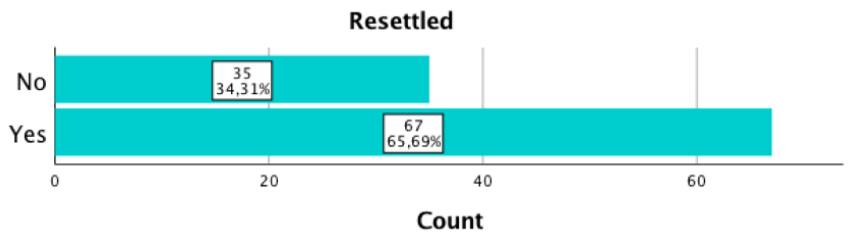
Graph 10: Age Distribution (Author 2019)



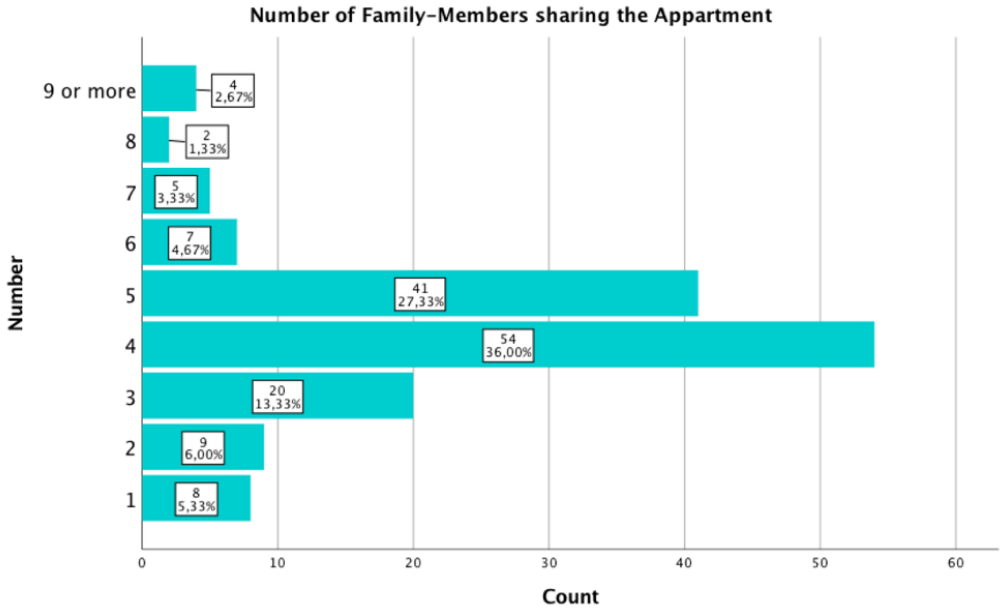
Graph 11: Education Levels (Author 2019)



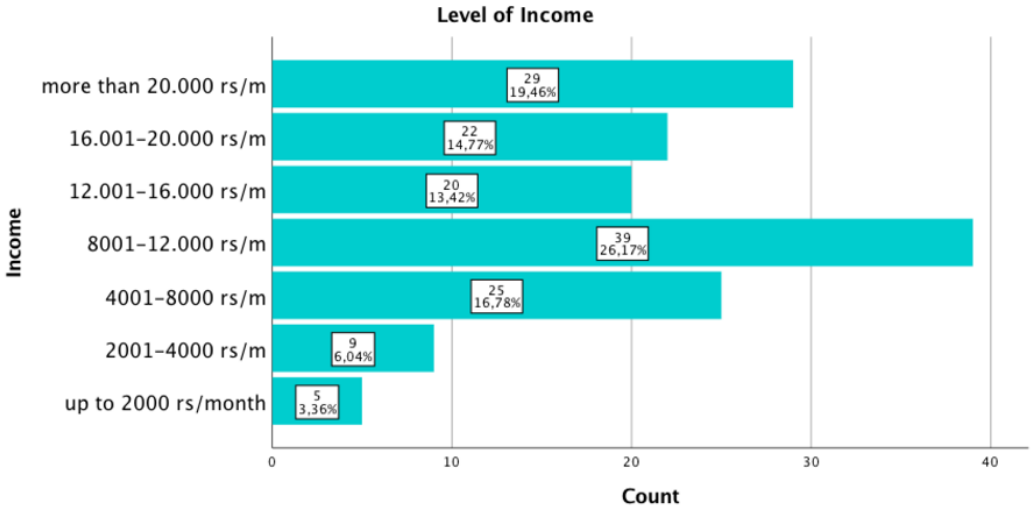
Graph 12: Length of Stay in Kannagi Nagar (Author 2019)



Graph 13: Voluntary or Forced Relocation (Author 2019)



Graph 14: Number of Family-Members sharing the Apartment (Author 2019)



Graph 15: Level of Income (Author 2019)

Annex 3.3 Addition corresponding to Section 4.2.2

The following Figures 11 and 12 show the transformation from the originally planned indicators and variables to the newly created variables based on the EFA, the CFA and the Cronbach Alpha test.

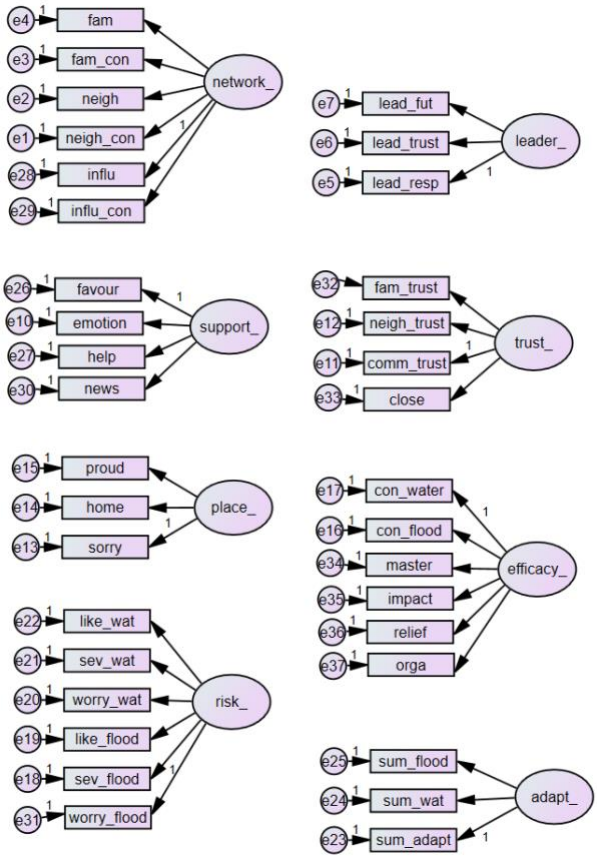


Figure 11: Original Indicators and Variables based on the Operationalization (Author)

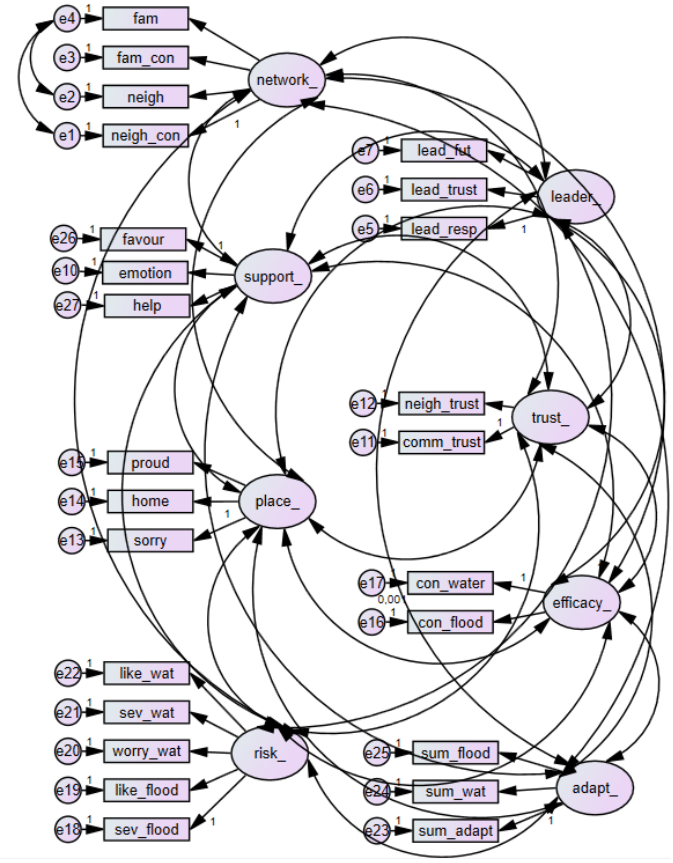


Figure 12: Newly created variables based on the EFA, the CFA and Cronbach Alpha test (Author 2019)

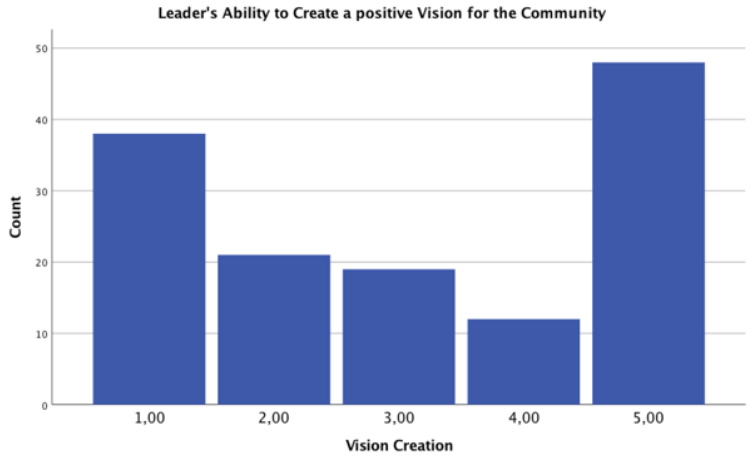
From the Descriptive Statistics of the newly aggregated variables in Table 6 the following can be concluded: Apart from sum_all_adapt, which is a scale of points from 0 to 27, all variables are measured with a Likert-scale from 1 to 5. All variables have a mean in the upper half – especially the three concepts Social Support, Collective Efficacy and Risk Appraisal – reflecting that the respondents have a high community feeling and understanding of the risk they are facing. The standard deviation is the biggest for the variables Visionary Leadership, Place Attachment and Social Support, where respondents differ the most in their perception.

	N	Minimum	Maximum	Mean	Std. Deviation
leader	140	1,00	5,00	3,1179	1,55418
network_new	149	1,00	5,00	3,5034	1,04425
support_new	150	1,00	5,00	3,6733	1,12971
trust_new	150	1,00	5,00	2,6567	1,21806
place_att	150	1,00	5,00	2,9400	1,52291
efficacy_new	149	1,00	5,00	3,3054	1,37756
risk_new	150	2,00	5,00	3,9387	,68655
sum_all_adapt	155	2,00	19,00	11,0700	3,76114
Valid N (listwise)	138				

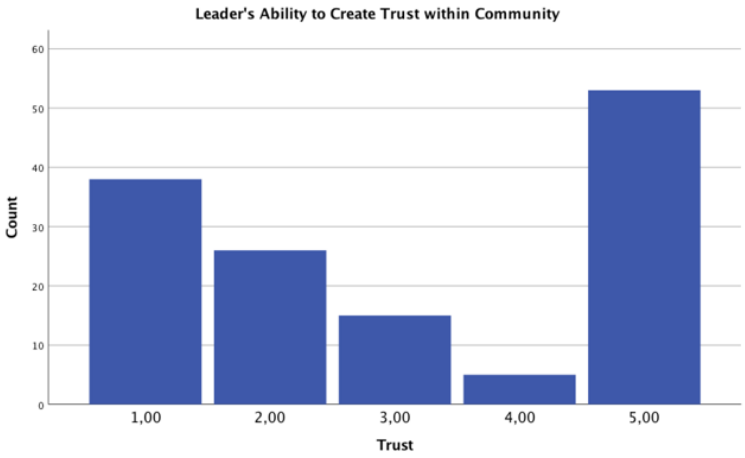
Table 6: Descriptive Statistics (Author 2019)

```
RECODE lead_trust (1=2) (2=2) (3=3) (4=4) (5=5) (0=1) INTO lead_trust_new.
EXECUTE.
```

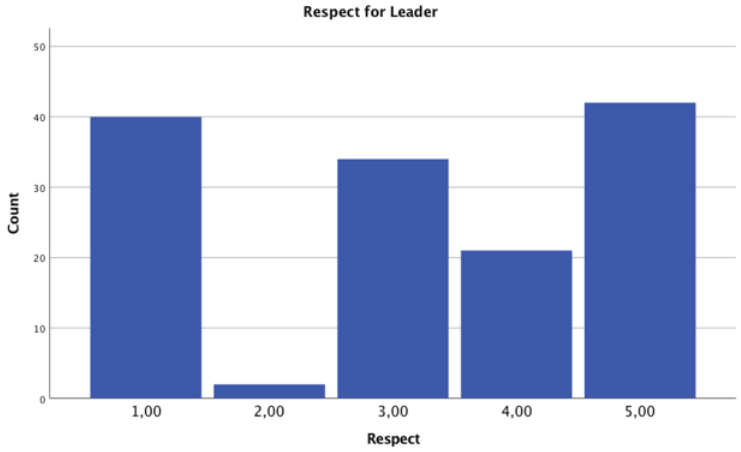
Figure 13: Recoding of Visionary Leadership



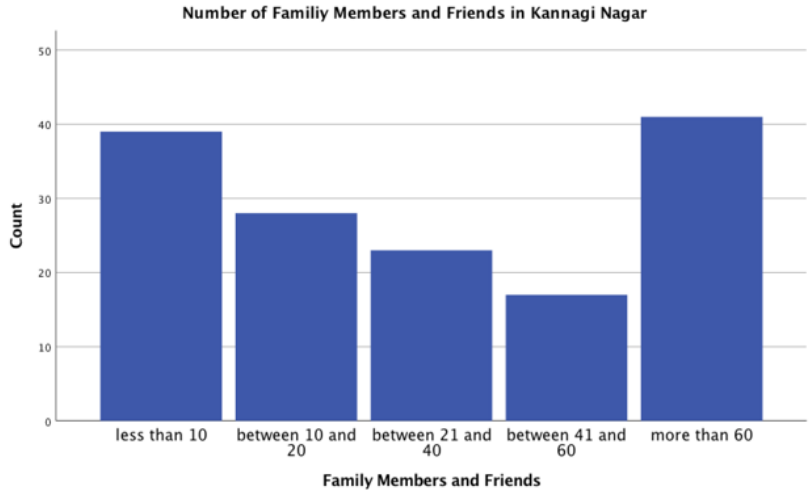
Graph 16: Leader's Ability to Create a Positive Vision for the Community (Author 2019)



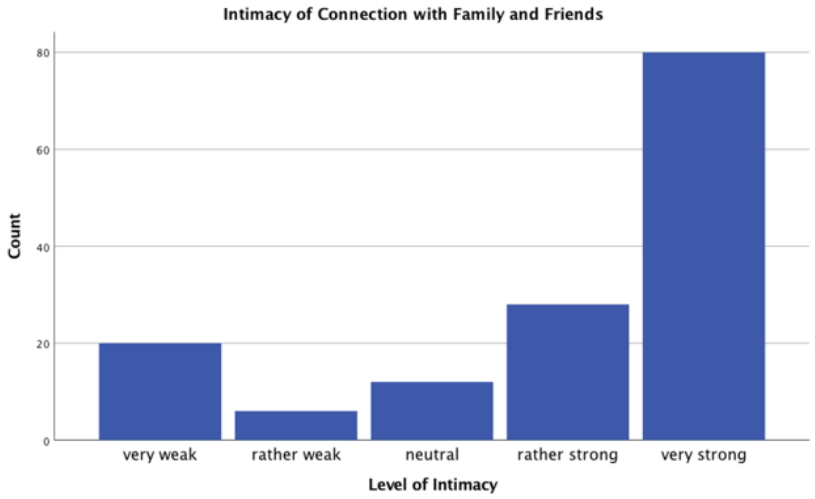
Graph 17: Leader's Ability to Create Trust within the Community (Author 2019)



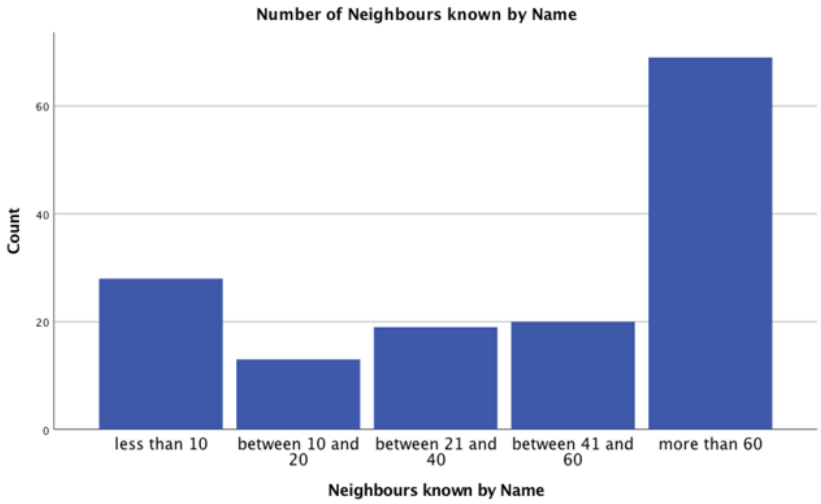
Graph 18: Respect for the Leader (Author 2019)



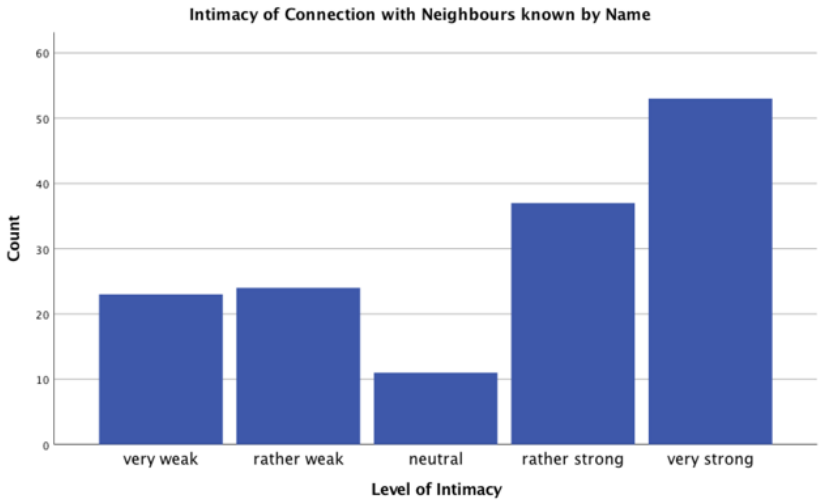
Graph 19: Number of Family Members and Friends in Kannagi Nagar (Author 2019)



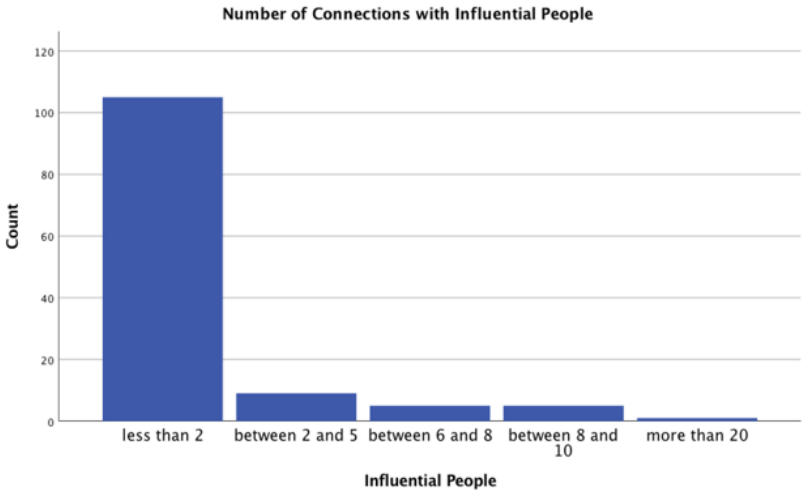
Graph 20: Intimacy of Connection with Family and Friends (Author 2019)



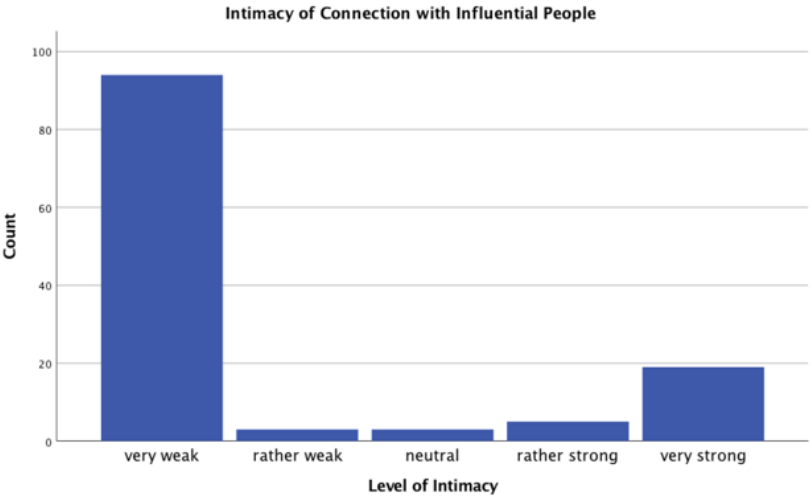
Graph 21: Number of Neighbours known by Name (Author 2019)



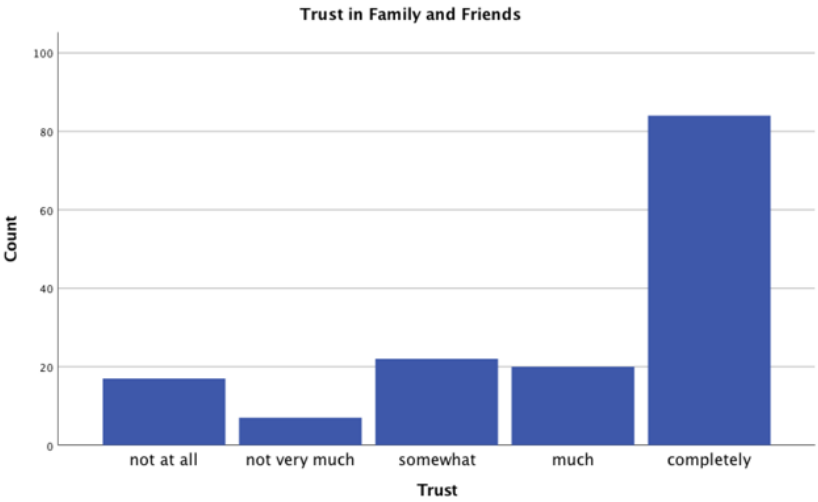
Graph 22: Intimacy of Connection with Neighbours known by Name (Author 2019)



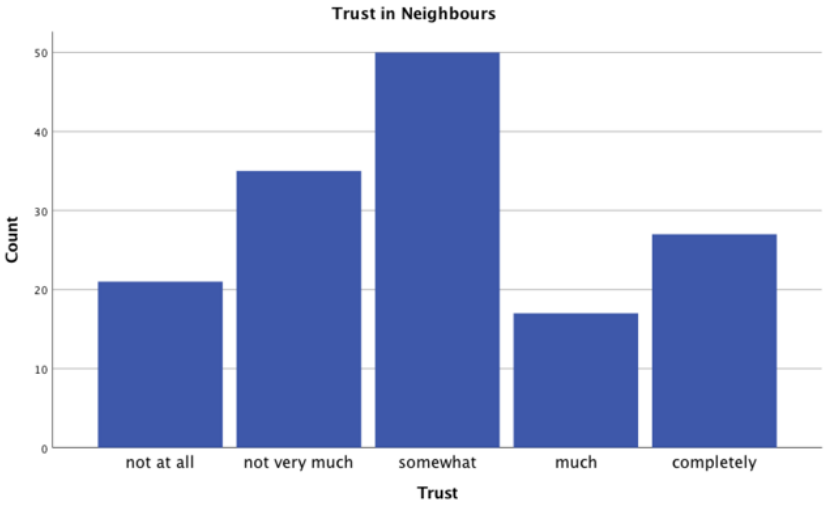
Graph 23: Number of Connection with Influential People (Author 2019)



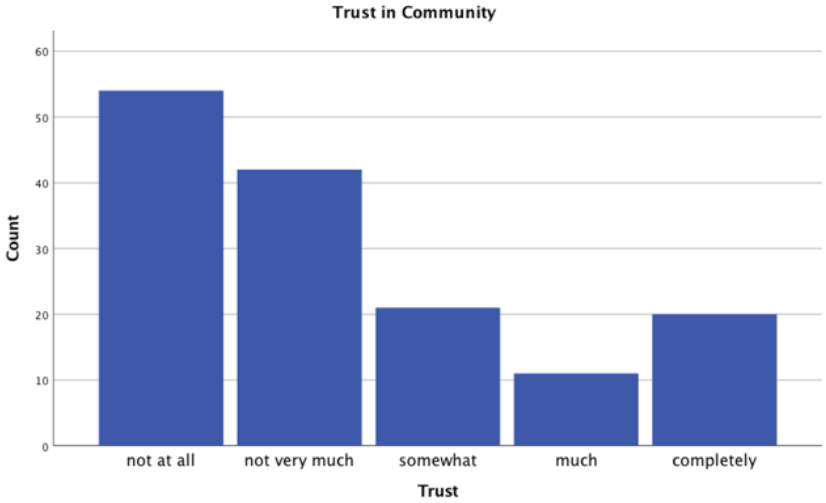
Graph 24: Intimacy of Connection with Influential People (Author 2019)



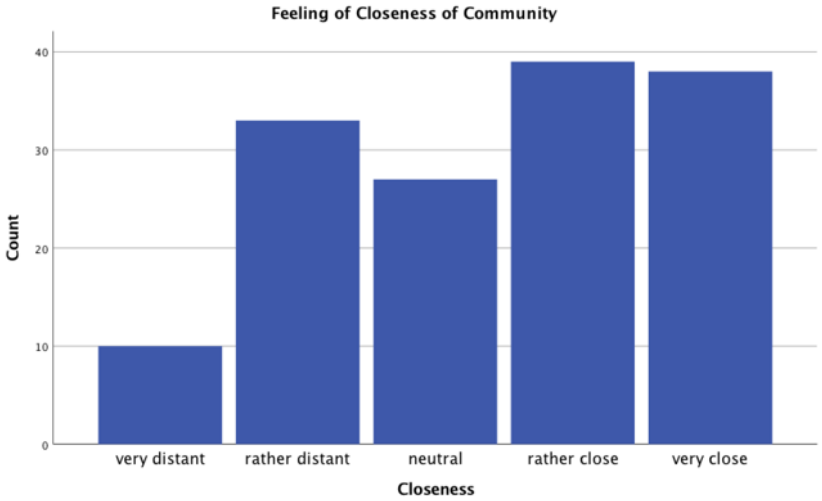
Graph 25: Trust in Family and Friends (Author 2019)



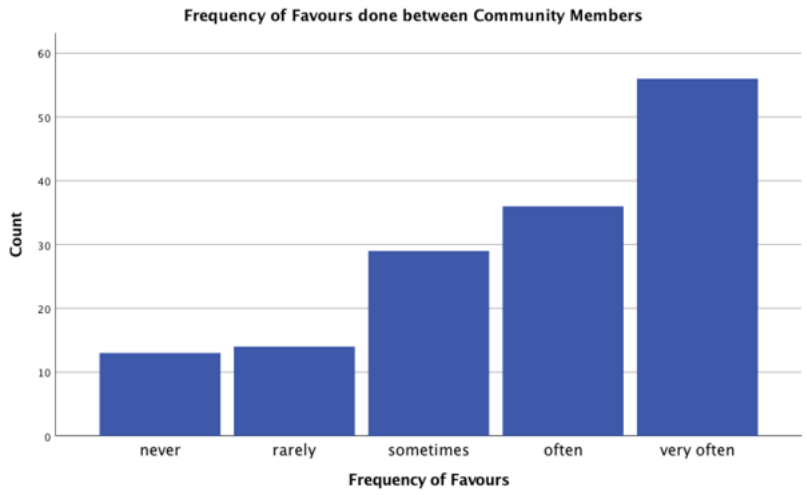
Graph 26: Trust in Neighbours (Author 2019)



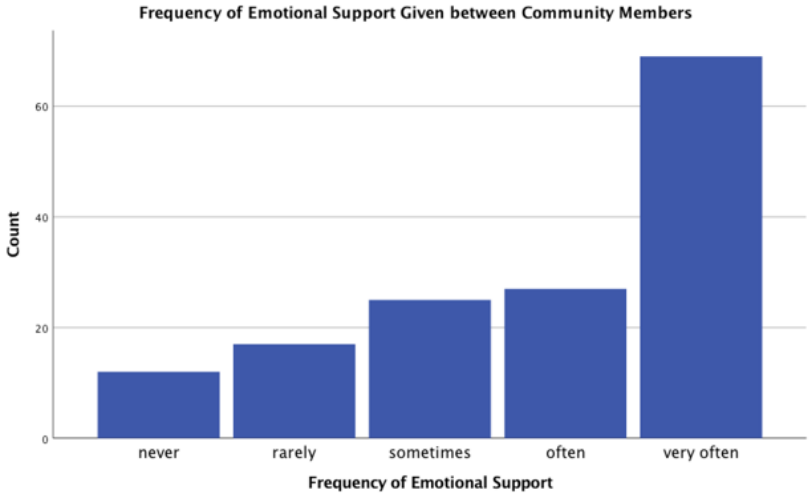
Graph 27: Trust in Community (Author 2019)



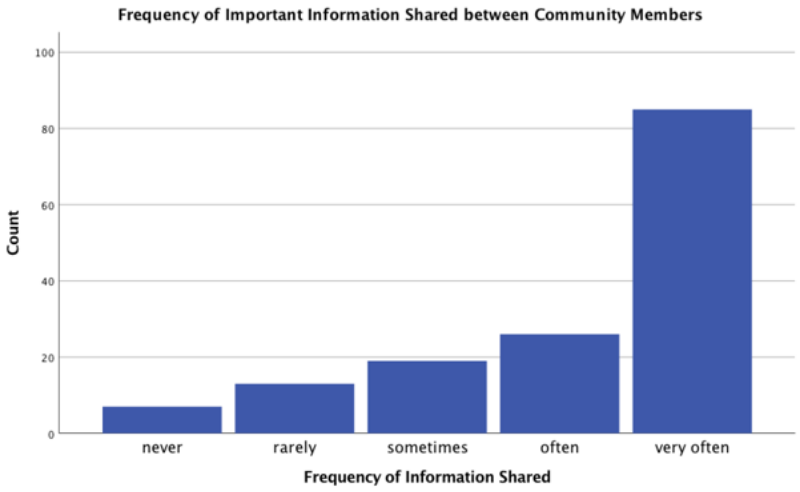
Graph 28: Feeling of Closeness of Community (Author 2019)



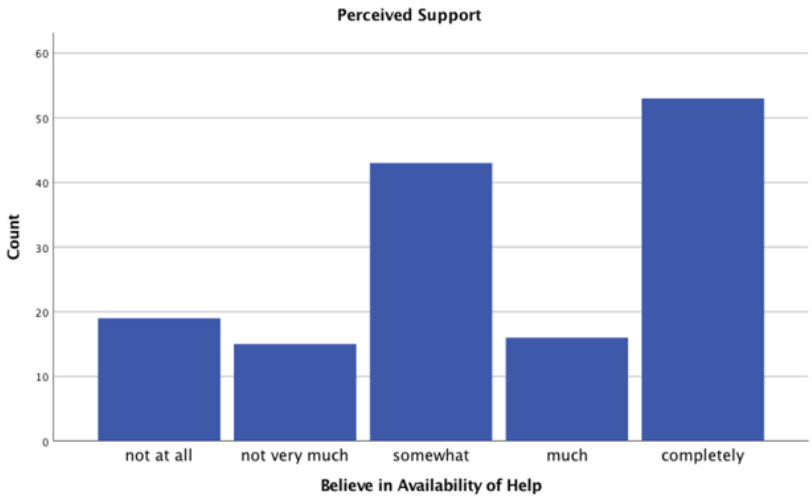
Graph 29: Frequency of Favours done between Community Members (Author 2019)



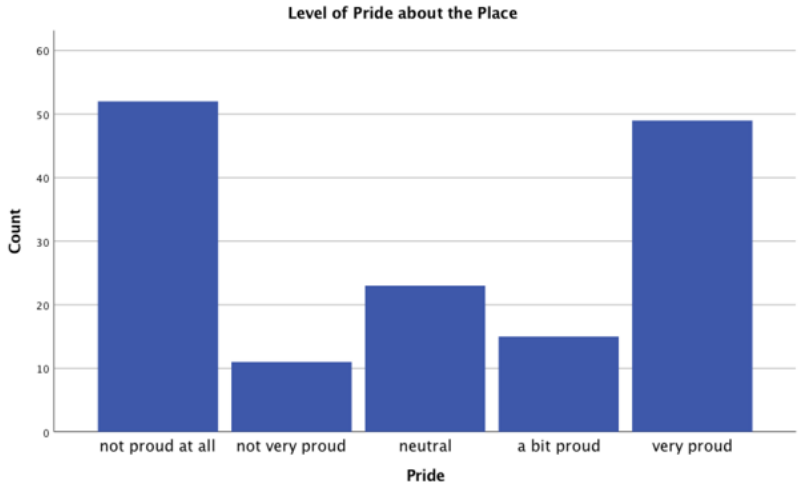
Graph 30: Frequency of Emotional Support Given between Community Members (Author 2019)



Graph 31: Frequency of Important Information Shared between Community Members (Author 2019)

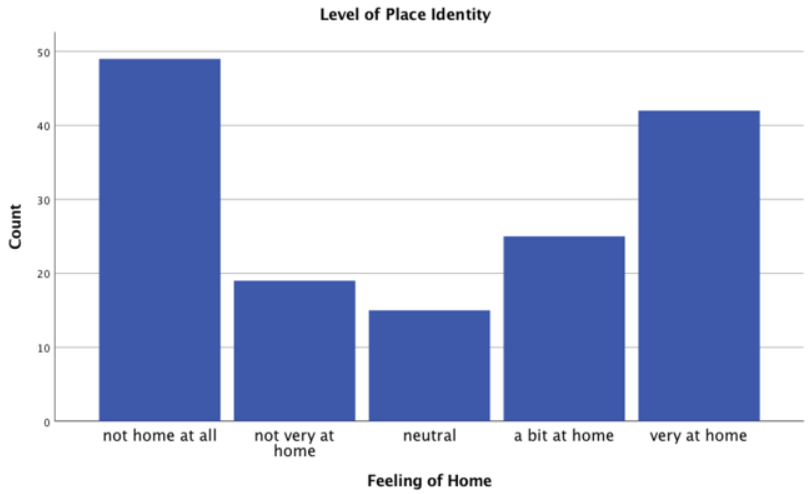


Graph 32: Perceived Support (Author 2019)

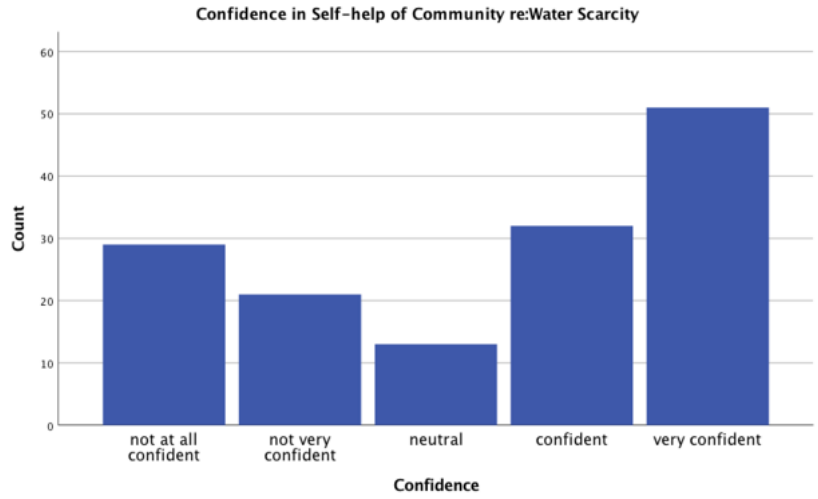


Graph 33: Level of Pride about the Place (Author 2019)

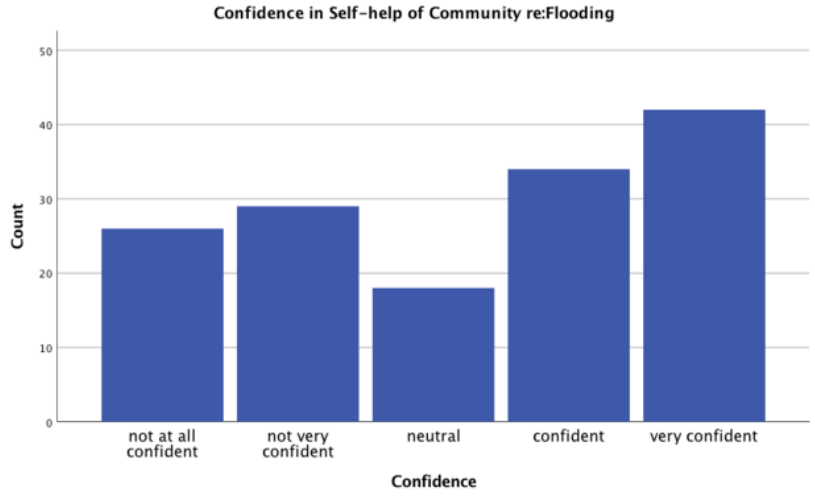
Graph 34: Level of Place Dependence (Author 2019)



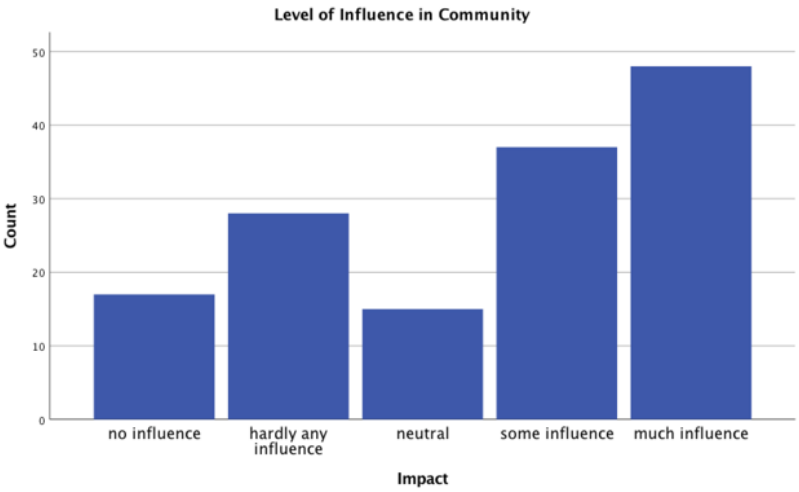
Graph 35: Level of Place Identity (Author 2019)



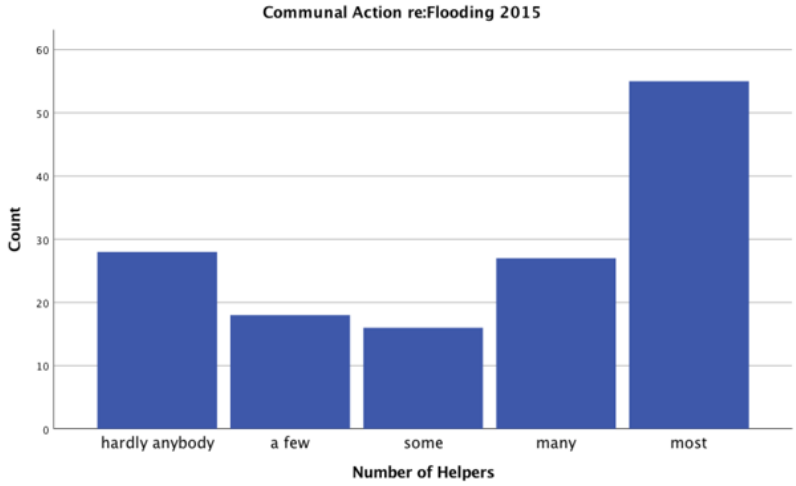
Graph 36: Confidence in Self-Help of Community regarding Water Scarcity (Author 2019)



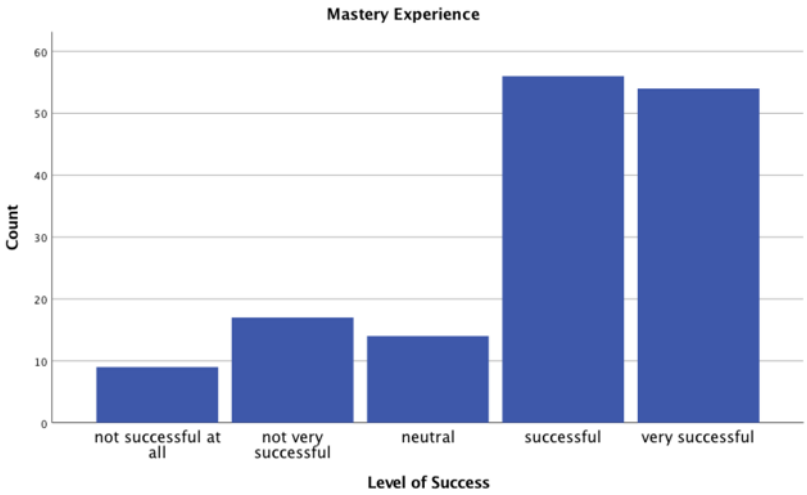
Graph 37: Confidence in Self-Help of Community regarding Flooding (Author 2019)



Graph 38: Level of Influence in Community (Author 2019)

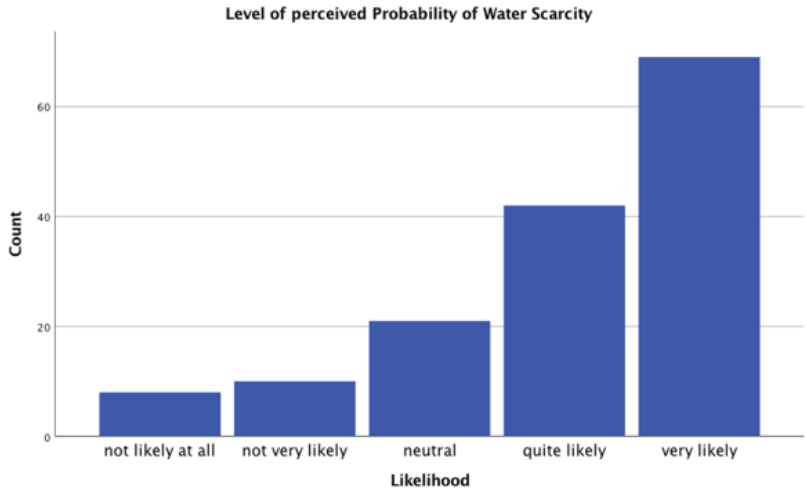


Graph 39: Communal Action regarding Flooding (Author 2019)

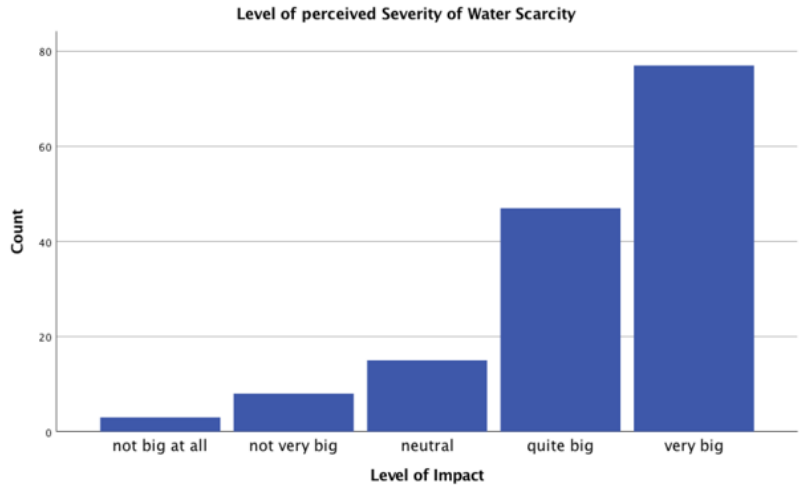


Graph 40: Mastery Experience (Author 2019)

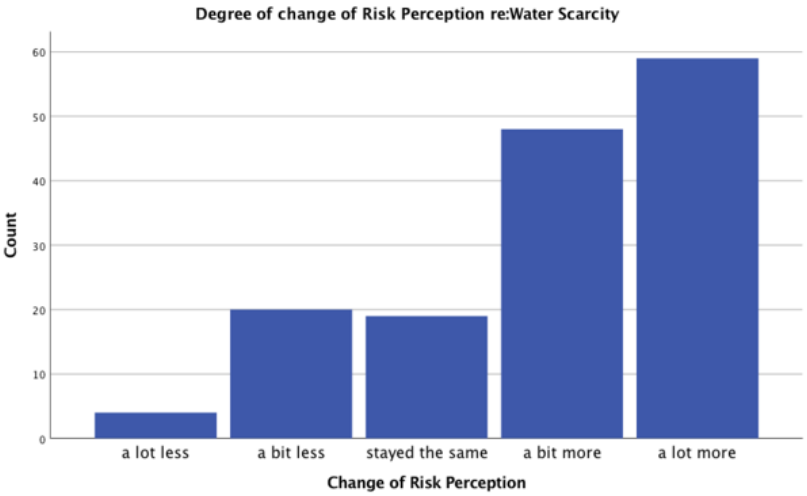
Graph 41: Level of Preparedness and Organisation (Author 2019)



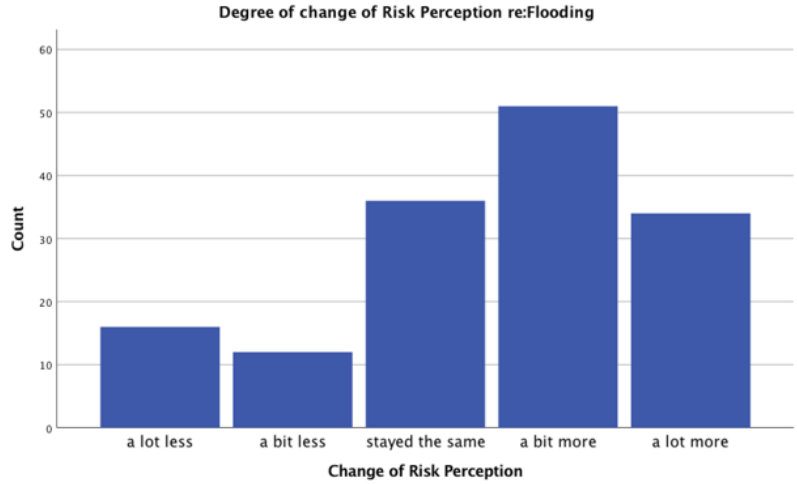
Graph 42: Level of Perceived Probability of Water Scarcity (Author 2019)



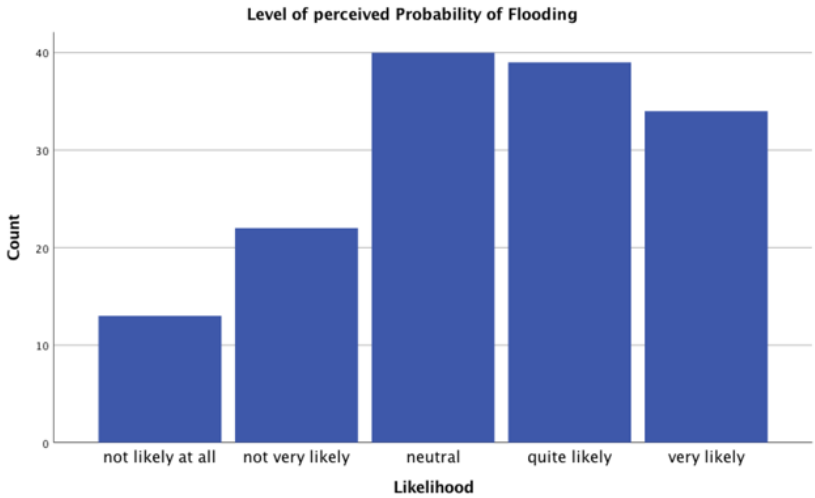
Graph 43: Level of Perceived Severity of Water Scarcity (Author 2019)



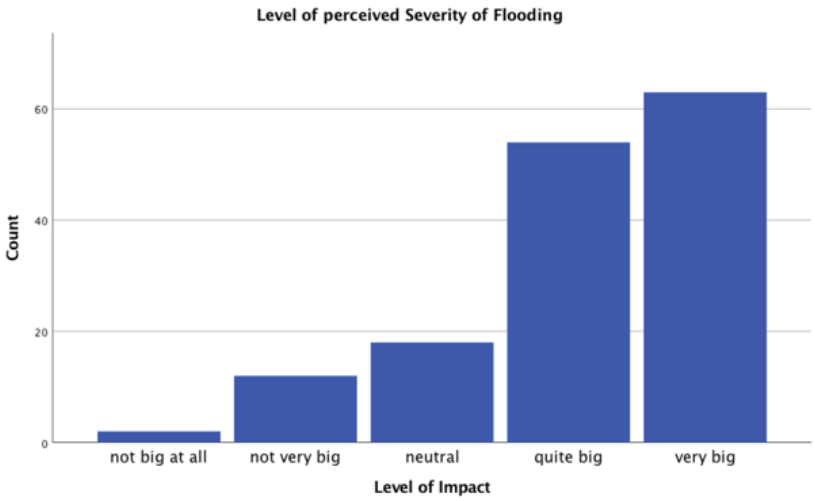
Graph 44: Degree of Change of Risk Perception regarding Water Scarcity (Author 2019)



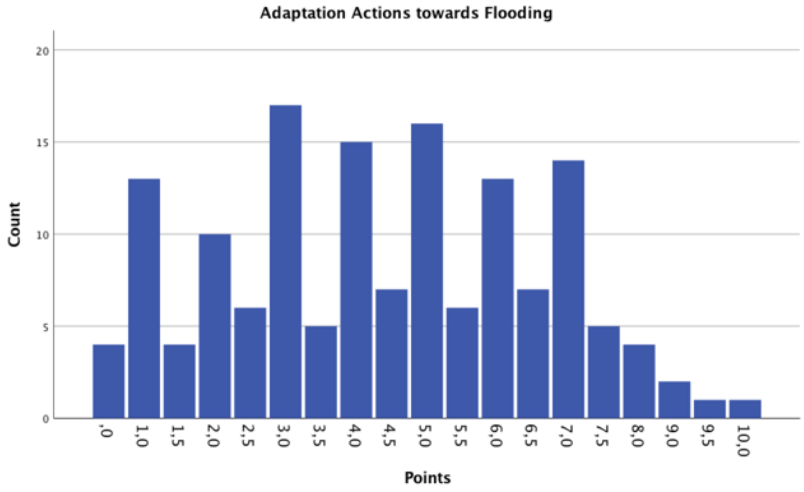
Graph 45: Degree of Change of Risk Perception regarding Flooding (Author 2019)



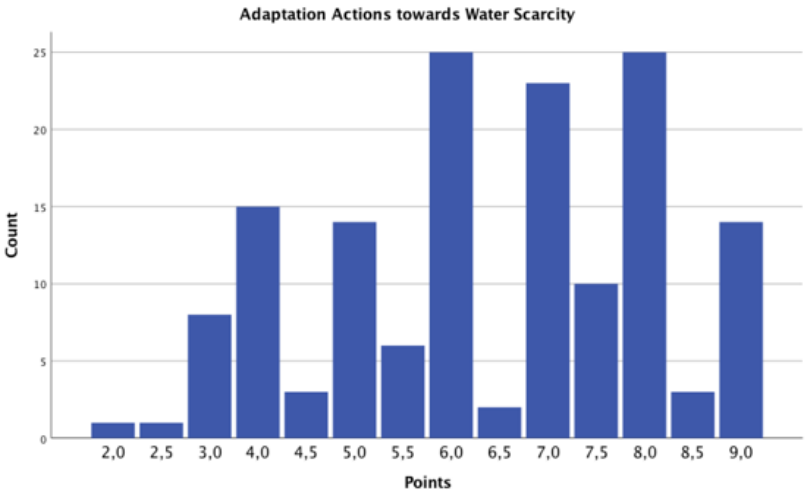
Graph 46: Level of Perceived Probability of Flooding (Author 2019)



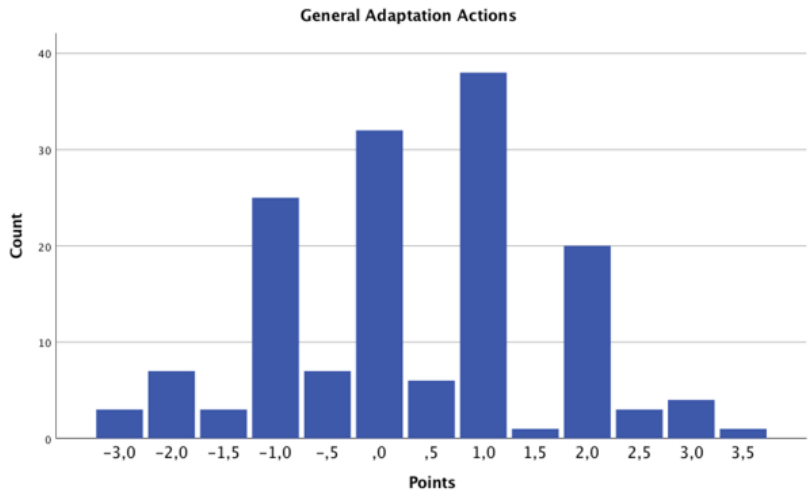
Graph 47: Level of Perceived Severity of Flooding (Author 2019)



Graph 48: Adaptation Actions in response to Flooding



Graph 49: Adaptation Actions in response to Water Scarcity



Graph 50: General Adaptation Actions

Annex 3.4 Addition corresponding to Section 4.2.3

EFA Tests:

The output of the final Exploratory Factor Analysis with the Maximum Likelihood Method in SPSS shows a still acceptable KMO of 0.703 and a Goodness of Fit test with a significance of 0.026*, which means that the matrix is not an identity matrix and can be run. Also, the discriminant validity is given, with no factor correlation higher than the threshold of 0.7, proving that the factors are distinct. The following table of the Pattern Matrix shows the loadings of the final indicators and to the according variables (Table 7). A sufficient factor loading for 150 respondents is 0.45 (Hair et al. 2010).

Variable	1	2	3	4	5	6	7
con_water				0.647			
con_flood				1.031			
like_wat							0.488
sev_wat							0.542
worry_wat							0.797
like_flood							
sev_flood							
lead_fut	0.924						
lead_trust	0.940						
lead_resp	0.921						
fam			0.640				
fam_con			0.478				
neigh			0.656				
neigh_con			0.342				
favour					1.068		

emotion					0.653		
help							
neigh_trust						0.948	
comm_trust						0.680	
proud		0.872					
home		0.801					
sorry		0.851					
sum_flood							
sum_wat			0.442				
sum_adapt			0.569				

Table 7: Pattern Matrix of EFA (Author 2019)

CFA Tests:

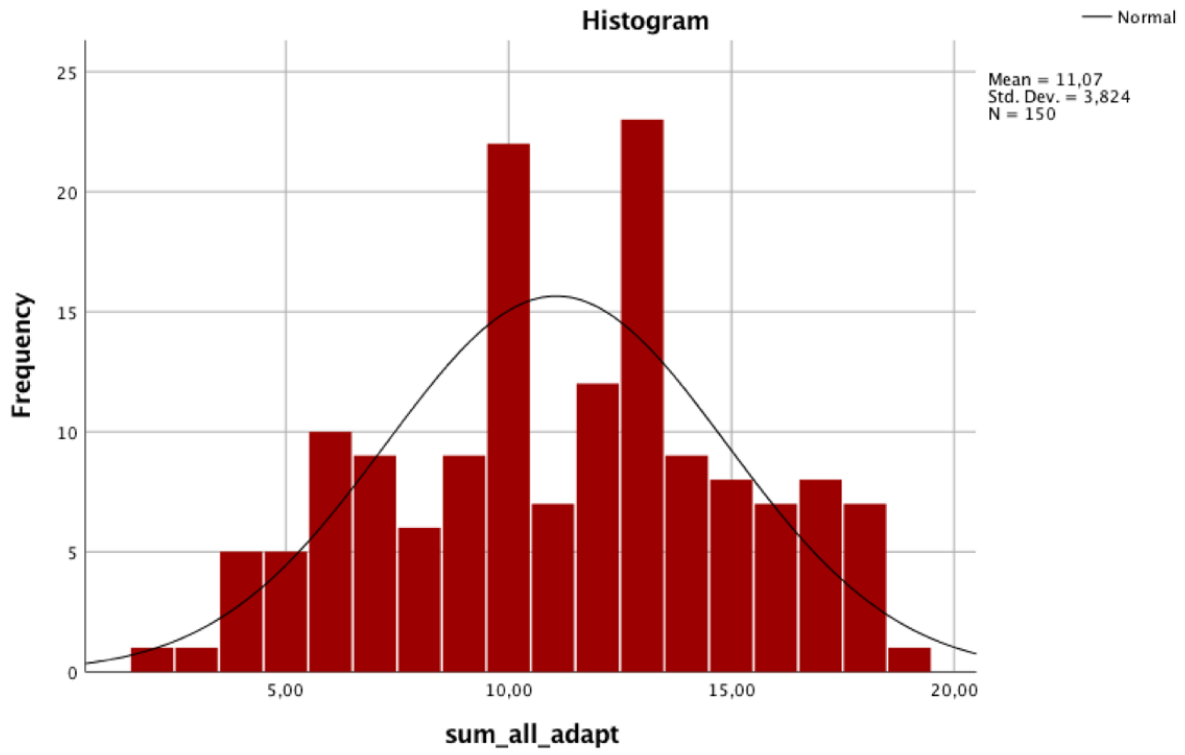
The corresponding Validity and Reliability test for the CFA shows that the variables Risk Appraisal, Social Network and Adaptation are not reaching the thresholds of AVE and CR, and the indicators of network and adaptation are correlating stronger with each other than with their responding variable (Table 8). These shortcomings are accepted for the analysis, based on the explanations presented in section 4.2.3. Additionally, a Common Method Bias test is conducted, proving that there is no bias as only 11.6% can be explained by one common factor.

	CR	AVE	MSV	MaxR(H)	risk_	network_	leader_	support_	trust_	place_	efficacy_	adapt_
risk_	0,608	0,265	0,067	0,759	**0,515**							
network_	0,638	0,312	0,497	0,661	-0,146	**0,559**						
leader_	0,949	0,862	0,028	0,953	-0,020	0,073	**0,928**					
support_	0,795	0,570	0,275	0,829	0,137	0,378	0,076	**0,755**				
trust_	0,785	0,647	0,284	0,796	-0,082	0,506	0,002	0,473	**0,804**			
place_	0,865	0,682	0,284	0,868	-0,258	0,380	0,168	0,250	0,533	**0,826**		
efficacy_	0,823	0,708	0,249	0,998	-0,074	0,162	0,039	0,196	0,275	0,253	**0,842**	
adapt_	0,515	0,267	0,497	0,533	0,003	0,705	0,076	0,524	0,417	0,333	0,499	**0,517**

Table 8: Validity and Reliability Test (Author 2015)

Parametric Tests:

In order to also conduct the parametric tests Pearson's Correlation Test and Regression Analysis in SPSS, the following assumptions and requirements are tested for (Field 2009): The Normality Assumption for the dependent variable Adaptation is attested with the Shapiro-Wilk test, which presents the p-value that equals to 0.051, which means the null hypothesis can be accepted and a normal distribution of the data can be assumed. Moreover, the histogram of the dependent variable shows a proxy to a bell shape, with only a minor negative skewness to the right of -0.101 (<1 and >-1) and a light-tailed kurtosis of -0.681, which is less than three times the Standard Error (Graph 51). Thus, an approximate symmetry and normality of the data is verified.



Graph 51: Histogram of Sum of All Adaptations (Author 2019)

Homoscedasticity is also given, as the residuals of the dependent variable are equal across the regression line, seen as a consistent pattern on the scatterplots for the independent variables Community Resilience and Risk Appraisal (Figures 13 and 14).

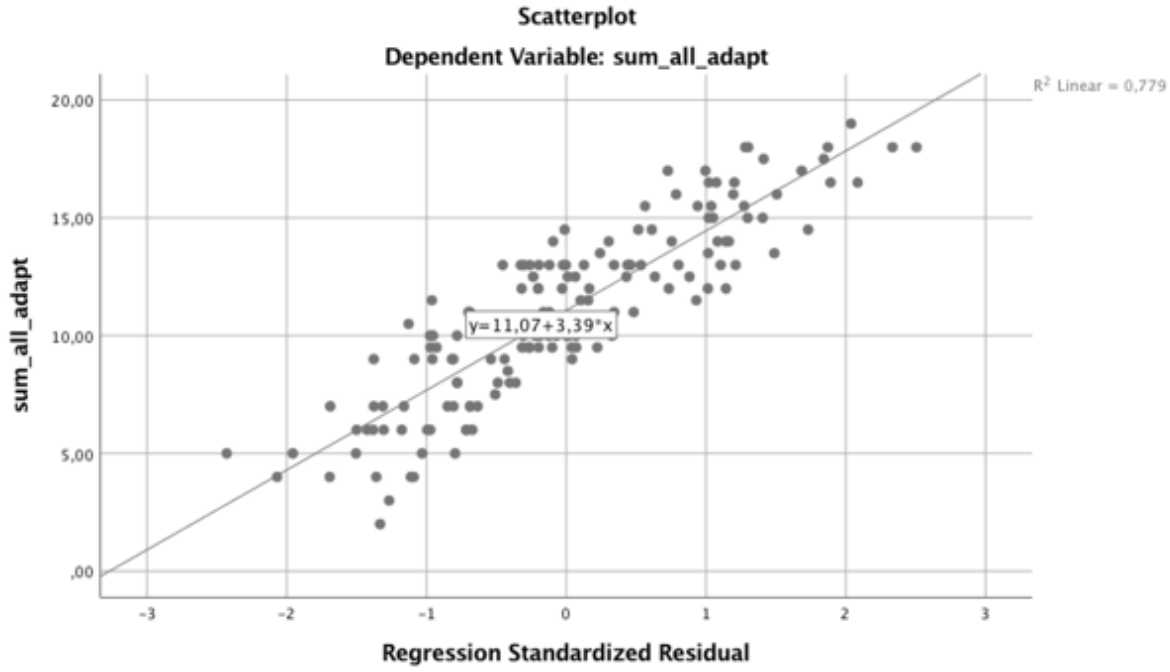


Figure 14: Scatterplot for Community Resilience (Author 2019)

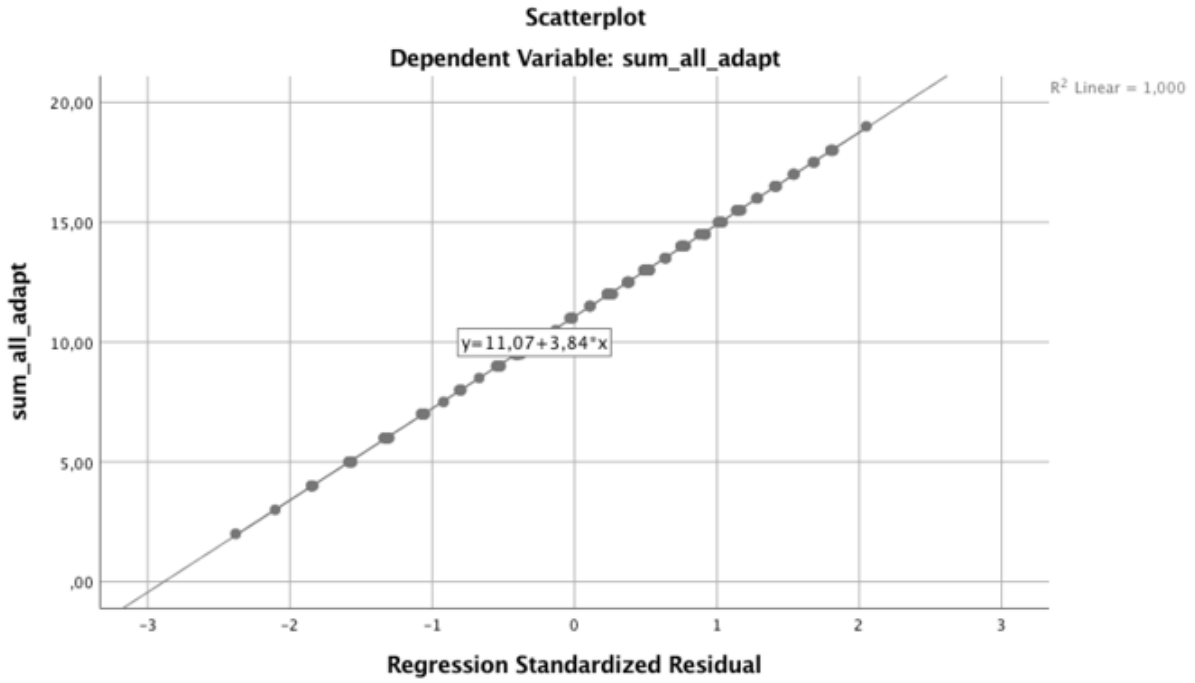


Figure 15: Scatterplot for Risk Appraisal (Author 2019)

Furthermore, linearity is also validated, as the deviation from linearity is higher than 0.05 for Risk Appraisal (0.854) and Community Resilience (0.271) combined with Adaptation Actions. The Collinearity Diagnostics show that also the multicollinearity of the independent variables is given, as the Variance Inflation Factor of the linear regression is lower than 3 for all iterations. Autocorrelation does not need to be tested for as with questionnaire data there is no order in the respondents. The other assumptions for parametric tests are also met, as all newly computed variables are semi-continuous variables, there are no outliers in the data (see Figure 16), the data follows a linear relationship and for every observation of the independent variable, there is a corresponding observation of the dependent variable. Following, all needed tests have been positively conducted.

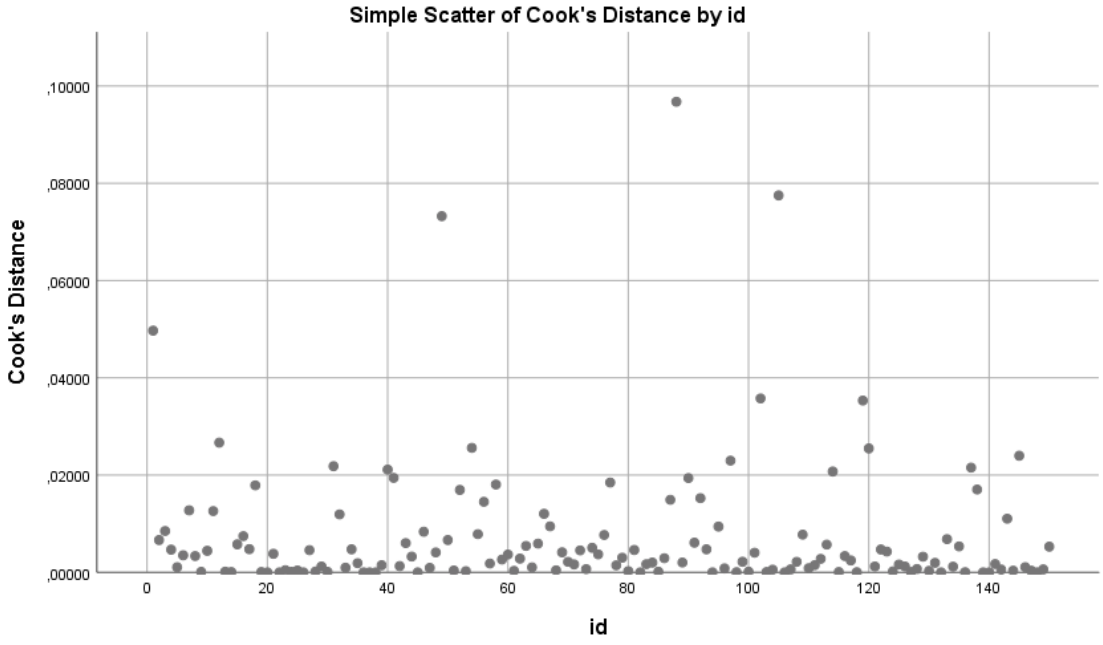


Figure 16: Cook's Distance Test for Outliers (Author 2019)

Correlations

		leader	network_new	support_new	trust_new	place_att	efficacy_new
leader	Pearson Correlation	1	,030	,063	-,021	,149	,089
	Sig. (2-tailed)		,729	,458	,801	,079	,298
	N	140	139	140	140	140	139
network_new	Pearson Correlation	,030	1	,320**	,308**	,236**	,060
	Sig. (2-tailed)	,729		,000	,000	,004	,470
	N	139	149	149	149	149	148
support_new	Pearson Correlation	,063	,320**	1	,439**	,263**	,247**
	Sig. (2-tailed)	,458	,000		,000	,001	,002
	N	140	149	150	150	150	149
trust_new	Pearson Correlation	-,021	,308**	,439**	1	,415**	,250**
	Sig. (2-tailed)	,801	,000	,000		,000	,002
	N	140	149	150	150	150	149
place_att	Pearson Correlation	,149	,236**	,263**	,415**	1	,221**
	Sig. (2-tailed)	,079	,004	,001	,000		,007
	N	140	149	150	150	150	149
efficacy_new	Pearson Correlation	,089	,060	,247**	,250**	,221**	1
	Sig. (2-tailed)	,298	,470	,002	,002	,007	
	N	139	148	149	149	149	149

**. Correlation is significant at the 0.01 level (2-tailed).

Table 9: Correlation Matrix for the Parameters of Community Resilience (Author 2019)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2	Sig. F Change
1	,470[a]	,221	,216	3,38618	,221	41,995	1	148	,000

a. Predictors: (Constant), community_resilience

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	481,519	1	481,519	41,995	,000[b]
	Residual	1696,996	148	11,466		
	Total	2178,515	149			

a. Dependent Variable: sum_all_adapt

b. Predictors: (Constant), community_resilience

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4,054	1,117		3,628	,000
	community_resilience	2,184	,337	,470	6,480	,000

a. Dependent Variable: sum_all_adapt

Table 10: SPSS Regression Outputs for Community Resilience towards Adaptation Behaviour (Author 2019)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics			
					R Square Change	F Change	df1	df2	Sig. F Change
1	,285[a]	,081	,075	1,32494	,081	12,990	1	147	,000

a. Predictors: (Constant), sense_com_new

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22,803	1	22,803	12,990	,000[b]
	Residual	258,052	147	1,755		
	Total	280,856	148			

a. Dependent Variable: efficacy_new

b. Predictors: (Constant), sense_com_new

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1,834	,422		4,340	,000
	sense_com_new	,459	,127	,285	3,604	,000

a. Dependent Variable: efficacy_new

Table 11: SPSS Regression Outputs for Sense of Community towards Collective Efficacy (Author 2019)

Model	DF	CMIN	P
Structural weights: Gender	1	0.443	0.506
Structural weights: Voluntary/forced Relocation	1	1.300	0.254

Table 12: Multigroup Analysis – Output of the Chi Square Test (Author 2019)

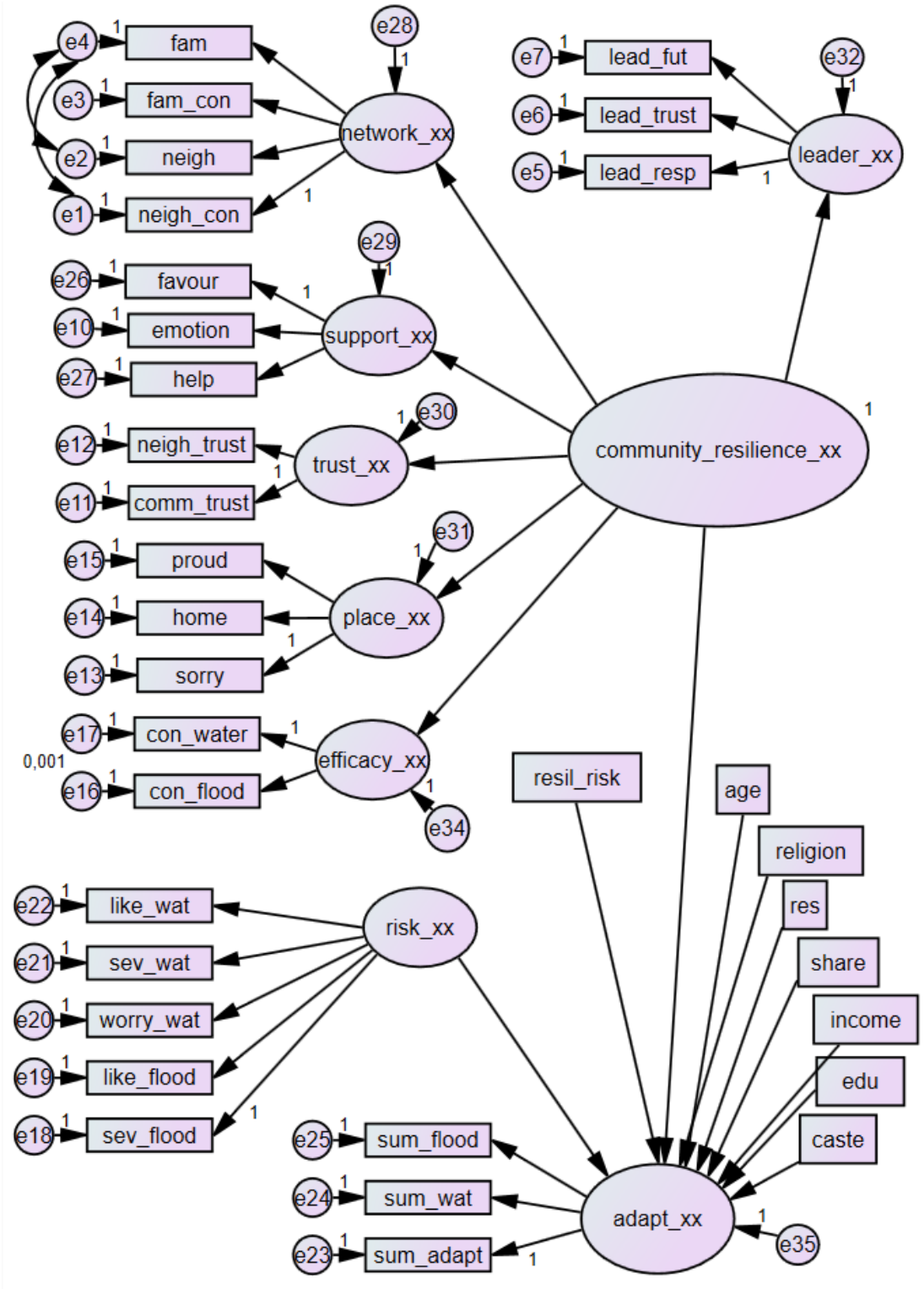


Figure 17: SEM for the Moderating Effect of Risk Appraisal (resil_risk) (Author 2019)

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